

PRELIMINARY REPORT: EFFICIENT PRODUCTS PROGRAM EVALUATION

This preliminary report of the evaluation of Efficiency Vermont's (EVT's) statewide residential Efficient Products Program has been developed to assist the Department of Public Service (DPS) in meeting its reporting obligations to the Vermont Public Service Board (the Board). Data collection and analysis activities to support the evaluation are in various stages of completion, with delivery of the final Phase 1 evaluation scheduled for September 2002.

The objectives of this report are to:

- Summarize the objectives, activities, and status of the Efficient Products Program (EPP) evaluation.
- Present key preliminary findings of the market characterization and process evaluation elements of the evaluation.
- Identify key issues to be examined in the remaining evaluation research and analysis.
- Discuss preliminary recommendations regarding program design and operation that emerge from the analysis completed to date.

1.1 INTRODUCTION

1.1.1 Program Description and Accomplishments through 2001

Program Objectives. The stated objectives of the EPP are to :

- Increase market recognition of ENERGY STAR labeled products;
- Increase the level of awareness and knowledge of consumer benefits of compact fluorescent lighting and energy-efficient appliances;
- Increase the level of customer adoption of efficient residential lighting and appliances;
- Increase retailer and dealer stocking and promotion of efficient residential lighting and appliances;
- Increase use of efficient lighting and appliances in multifamily and institutional residential markets.

Program Services, Incentives, and Operations. The program offers the following services and incentives.

- ***Customer Services and Incentives*** include point of purchase rebates for compact fluorescent bulbs and fixtures, catalog sales at discounted prices of compact fluorescent

bulbs and fixtures, and rebates for the purchase of ENERGY STAR-qualified resource efficient clothes washers. Rebate levels for compact fluorescent bulbs were initially set at \$6; they were lowered to \$4 by the end of 2001. Non-torchiere light fixture rebates were reduced from \$20 to \$15 during 2001. Washer rebates were initially set at \$100 and lowered to \$75 during the first program year. They were reduced in June 2001 to \$50. In addition to instant rebates, the program has sponsored a number of special events to promote and sell efficient lighting products, including a number of torchieres turn-ins.

- **Retailer Services.** The program offers a number of services to retailers participating in the program, including installation of point of purchase displays, assistance in ordering and stocking qualifying products, and sales staff training. Incentive processing and retailer support services are provided by Applied Proactive Technologies, Inc.
- **Marketing.** EVT participates in the national ENERGY STAR brand recognition effort, undertakes local advertising, and stages special promotion events to support program activities.

Program Accomplishments through December 2001. Table 1-1 summarizes key indicators of program activity for the first two years of program operation.¹

Table 1-1
Summary of Efficient Products Program Activities

Component/ Year	# of Stores Enrolled	# of Participants (Rebate Recipients)	# of Rebates Issued	Other Accomplishments/Activities
Appliances				
2000	60	1,972	Washers: 1,972	
2001	70	2,715	Washers: 2,719	
Lighting				
2000	105	12,000	All Types: 61,000	Torchiere Turn-in: 3000 halogen torchieres exchanged; 5,300 bulbs and 400 fixtures sold.
2001	125	25,609	CFLs: 96,239 Fixtures: 23,232 Torchieres: 4,546	36 Special Events: Torchiere turn-ins, home show booths, in-store promotions.

1.1.2 Phase 1 Evaluation Objectives and Status

Objectives. The key objectives for Phase 1 of the EPP evaluation are as follows.

- **Characterize baseline market conditions.** Develop a detailed profile of the residential lighting markets in the early phases of the program. Key elements of the demand-side baseline profile include: number and demographic characteristics of customers; sales and

¹ The program was launched in March 2000.

market share of efficient (ENERGY STAR); saturation of efficient models in the installed stock; customer market segmentation in regard to purchase of efficient models; customer knowledge of and attitudes towards efficient products; barriers to purchase of efficient products. On the supply side, key elements of the profile include: numbers and types of firms in the retail supply chain; level of stocking and display of efficient models; pricing of efficient models; segmentation in regard to promotion of efficient models; and perceived importance of the promotion of efficient models to overall business success.

- ***Process evaluation.*** The process components of the first round evaluation activities focus primarily on identifying potential improvements to the efficiency and effectiveness of program marketing, delivery, and administration. Among the key research questions addressed are the following.
 1. How effective has the program been in enrolling retailers? What reasons do retailers provide for declining enrollment?
 2. How effective are sales floor staff in selling ENERGY STAR products, particularly appliances?
 3. To what extent are point-of-purchase materials displayed near ENERGY STAR products?
 4. How effective has program marketing to customers been? To what extent do customers recognize the programs and the products they support?
- ***Assessment of program market effects.*** It is too early in the program's operations to undertake a comprehensive assessment of market effects. However some of the research activities will produce early indicators of market effects. These include:
 - Changes in stocking and promotion practices for efficient products;
 - Changes in purchasing patterns among builders and remodelers;
 - Changes in customer awareness and knowledge of efficient lighting products and appliances.

Status of Evaluation Activities. Table 1-2 summarizes the research and analysis activities for Phase 1 of the EPP evaluation. Most of the retailer-oriented research is complete and results appear in this report. The major piece of customer research – an on-site survey of a random sample of 70 – 100 homes – is ready to be fielded, pending availability of field researchers currently assigned to the Residential New Construction program. After extensive negotiations with retailers, XENERGY is now receiving lighting and appliance sales data from selected stores. Some preliminary results of analysis of these sales data are discussed below.

Table 1-2
Summary and Status of EPP Phase 1 Evaluation Activities

TASK/ Objective	Description/Sample Approach & Size	Status
SUPPLY-SIDE ANALYSIS		
Analyze trends in stocking and pricing practices	Analyze floor inventory data collected annually by APT. Appliances: Data available for 60 stores representing ~ 90% of all appliance VT. retailers. Lighting: Data available for 100 stores: home centers, hardware, lighting specialty, discount.	Done
Retailer Survey: Questionnaire	In-depth interviews to probe use of ENERGY STAR in marketing and sales, perception of the effects of the program on customers; sales and promotion practices for energy efficient products pre and post program. Appliance Sample: 12 stores selected to represent population in terms of size, location and type of store. Lighting Sample: 12 stores selected to represent population in terms of size, location and type of store.	Done
Appliance Mystery Shopper	Conduct scripted shopping trips to retailers to gauge effectiveness of point of purchase display, sales staff initiative in selling efficient products, sales staff knowledge of efficient products, sales staff effectiveness in selling efficient products. Mystery shopper visits made to 8 stores – subset of the appliance retailer interview survey.	Done
DEMAND-SIDE ANALYSIS		
On-site Customer Survey	Protocol designed to capture information on number, type, location of lighting fixtures; saturation and efficiency of appliances, new measure opportunities, ENERGY STAR and program recognition. Random sample of VT residents eligible for program using commercially-available listing service as frame. Target completes – 70 – 100.	Protocol done. Sample recruited Survey in field in June
Pre-EVT Program Analysis	Review reports of predecessor lighting programs to assess contribution to product adoption.	To be done in June
SALES AND MARKET SHARE TRACKING	Obtain sales lighting and appliance sales data covering past several years from a representative group of stores in VT and comparable stores in areas without programs. Analyze sales data to estimate efficient product sales outside the program and assess extent of spillover. Compare to rebate data.	Lighting data in hand for some stores.

The remainder of this report present key findings from the preliminary market characterization and process evaluations for the lighting and appliance markets. The product categories and their respective supply chains are sufficiently different to warrant separate presentation.

1.2 THE RESIDENTIAL LIGHTING COMPONENT

1.2.1 Preliminary Market Characterization

We note that the major research effort designed to support characterization of the customer or demand side of the residential lighting market – namely the on-site customer survey – has not yet been fielded. Thus, the section on the demand side is based primarily on the results of research done in other states, applied to population characteristics in Vermont. The supply-side research is relatively complete and includes some retailer observations of customer motivations and barriers to purchase of efficient bulbs and fixtures.

Demand Side: Market Size and Segmentation

Replacement light bulbs: size of stock. The size of the total market for screw-base compact bulbs, from the point of view of stock or saturation, is a function of the number of housing units in Vermont, the number of screw-in fixtures per home, and the percentage of those fixtures that can accept CFLs. In 1997, the Vermont Department of Health estimated that there were 286,906 housing units in Vermont, of which 240,000 were year-round.

As part of a recent residential lighting market assessment conducted for KeySpan Energy, XENERGY conducted on-site surveys of a sample of 37 single- and multi-family housing units. One of the objectives of the on-site surveys was to develop estimates of the total number of fixtures in the population and the percentage of those fixtures that could be fitted with screw-in compact fluorescent lamps. The mean number of fixtures in the sample homes was 32.3; the mean number of bulbs in those fixtures was 43.5. We assumed that recessed cans, fluorescent tubes, chandeliers, vanity strips, track lighting, pendulums, torchieres will generally not accommodate a compact fluorescent bulb. These kinds of fixtures accounted for 30.6 percent of the total observed. These results are not necessarily transferable to Vermont, since they depend on the local mix of homes in terms of vintage and construction styles. However, they provide a sense of the magnitude of the stock of residential fixtures in Vermont that could be fitted screw-based CFLs. Applying the Long Island figures to the number of housing units in Vermont, we estimate that there are roughly 6.5 million residential fixtures that could be fitted with CFLs.

Fixture Purchases. A 1998 baseline study of the New England residential lighting market² estimated the number of fixtures purchased by residential customers by type and purchase decision driver (replacement, addition, etc.), based on the results of a telephone survey of 1170 households. The sample included households from Massachusetts, Connecticut, Rhode Island, New Hampshire, and Vermont. Scaling the results of the 1998 baseline study to the number of

² Opinion Dynamics Corp., 1998.

households in Vermont, we estimate that Vermont households annually purchase 340,000 fixtures.³

- ***Permanent v. portable fixtures.*** Sixty-one percent of fixtures purchased were permanent indoor or outdoor fixtures; the remaining 31 percent were portable fixtures.
- ***Replacement v. New Construction/Renovation.*** Thirty-four percent of all fixtures and 41 percent of all permanent fixtures are purchased for use in new construction or renovation projects. This finding highlights the importance of builders and (potentially) renovation contractors as fixture purchase decision makers.

Demand Side: Product Adoption and Barriers to Adoption

In the absence of results from the customer survey, our information on customer adoption and response to compact fluorescent products is fairly sketchy. However, combining information from residential lighting program evaluations and market assessments in the region with Vermont population statistics, we can get a sense of the scale of sales supported by the program.

- ***Compact Fluorescent Bulbs.*** The 1998 New England baseline study found that 30 percent of customers had at least one CFL bulb installed, with average holdings of 2.4 each or 0.8 bulbs per household averaged over the entire population. Survey results provided by Central Vermont Public Service Corporation and Green Mountain Power Corporation suggest a lower level of holdings in Vermont, in the range of 0.2 CFLs per household (or 48,000 bulbs statewide) prior to the program. According to rebate records, 27,600 customers purchased roughly 150,000 CFLs through the program. Even if we assume that the pattern of repeat participation found in other programs obtained in Vermont, we can estimate that roughly 10 percent of eligible households purchased CFLs through the program. Moreover, even if we assume that 10 – 20 percent of the bulbs purchased were not immediately installed⁴, we can conclude that purchases through the program significantly increased the installed stock of compact fluorescent bulbs.
- ***Compact Fluorescent Fixtures.*** In 2001, fixture purchases through the program accounted for 8 percent of all residential fixture purchases in Vermont. Given the relatively recent introduction of compact fluorescent fixtures and the relatively low level of retail stocking for such fixtures, this is a significant portion of the product flow.
- ***Remaining barriers to customer adoption.*** Retail lighting market assessment and program evaluations consistently identify a number of barriers to broader customer adoption of compact fluorescent products. These include high price, objections to appearance and lighting quality, and lack of fit in existing features. Despite recent and fairly dramatic decreases in the price of ENERGY STAR qualified products, improved

³ The split between owner and renter households in Vermont is roughly equal to that in the sample for the baseline survey.

⁴ Evaluations of residential lighting rebate programs typically find that 10 – 20 percent of bulbs purchased through the program are not immediately installed, but are reserved for spares or installed and later removed for a variety of reasons.

design, and increased retail availability, retailers interviewed for this study report that those barriers persist.

Supply Side: Market Size and Segmentation

Compact Fluorescent Bulbs. Recent studies based on customer interviews and check-out scanner data provide a fairly consistent picture of the relative size of various sales channels for compact fluorescent bulbs. Table 1-3 shows the distribution of retail sales through different kinds of stores. Program contractor Applied Proactive Technologies estimates that about 126 retail stores sell lighting products in Vermont. Of these, 125 are participating in the current Vermont lighting program. An analysis of the APT retailer database found that 49 percent of these stores could be classified as independents, 13 percent as national chain outlets, such as Sears and Home Depot, and 38 percent as regional chain outlets, primarily hardware stores.

Home centers, of which there are relatively few in Vermont, represent huge per store sales volumes. Preliminary analysis of sales data from the one large Vermont home center suggests that it sold more than 12,000 CFLs in 2001. By contrast, annual sales of CFLs for five branches of a regional hardware chain ranged from 500 to 2,000 units, with an average of 1,060 units. We note that recorded unit sales of CFLs at the home center in 2001 were roughly 4 times larger than unit sales reported by the lighting department manager in 2000.

Table 1-3
Distribution of Retail Sales of CFLs by Type of Store

Type of Store	National (Scanner Data)	Long Island (Customer Reports)
Home Center	66.5%	61%
Mass Merchandisers	20.6%	7%
Hardware	11.7%	21%
Grocery	0.9%	4%
Drug Store	0.2%	-
Lighting Supply Stores	-	7%

Fixtures. The most recent general studies of the lighting market indicate that home centers now constitute the largest channel for sales of hardwired fixtures into the residential market. National figures from a number of sources are not entirely consistent. However, they suggest that the largest chains: Home Depot, Lowe's, and Wal-Mart now account for 30 – 40 percent of all portable fixture sales. Specialty lighting stores play an important role in the market in terms of introducing new designs. However, once a certain design proves to be popular, it is copied, produced at lower costs overseas, and sold at lower prices and margins in home centers and mass merchandisers. Thus, with the consolidation of sales channels in home centers and mass merchandisers, a relatively small number of retailers exercise a great deal of power over product availability, pricing, and selection in the fixture market.

Supply Side: Stocking and Pricing Practices

Table 1-4 summarizes the results of a shelf inventory carried out by APT of all stores participating in the EPP lighting component in early 2001, about one year after program inception. At that time, all stores in the program stocked CFLs. Although the Home Centers did not stock any ENERGY STAR –*labeled* products, they apparently stocked ENERGY STAR-qualified products, because all three of the stores processed instant rebates. Results of a the Spring 2002 inventory are not yet available.

Table 1-4
Summary of Lighting Product Stocking and Pricing Practices: Early 2001

Store Type	Number of Stores Stocking Product	Variety of CFL Models Available		Average CFL Price		Percent Carrying Fixtures	
		Average Number of Models/Store	Avg. Percent with EnergyStar Label	Standard	EnergyStar Labeled	Fixture	Torchiere
Hardware Stores	59	4.9	11%	\$13.48	\$11.74	68%	14%
General & Supermkt	15	1.5	5%	\$16.60	\$22.09	0%	0%
Lighting/Electrical Supp	11	5.5	15%	\$21.63	\$19.12	55%	18%
Discount & Dept Stores	6	5.3	56%	\$16.15	\$9.65	33%	0%
Other	5	3.8	5%	\$17.31	\$27.00	40%	0%
Home Centers	3	6.7	0%	\$17.00	\$ -	67%	0%
Overall	99	4.5	14%	\$15.23	\$12.63	53%	10%

The following observations emerge from examination of Table 1-4.

- In studies of other state and regional markets, Home Centers have shown a clear lead in stocking and pricing CF products. For example, a recent study in Long Island found that home centers stocked an average of 19 screw-in models, including 12 ENERGY Star qualifying models. In Vermont, at least in the early stages of the program, the differences between home centers on one hand and hardware and discount department terms on the other were very small in terms of numbers of models stocked and availability of CF fixtures.
- Pricing differences related more to type of store than wattage or ENERGY STAR status of the bulb.
- General merchandise and grocery stores carried very few models.

According to store managers interviewed in early 2002, trends in stocking and sales of CFL products over the past year are mixed. Some reported that stocking and sales have increased while other report little change. Forty percent of the twelve store managers report that stocking and sales of CFL bulbs has increased while 40 percent report it has remained the same. About

one-quarter report that stocking and sales of CFL hardwired fixtures has increased over the past year while about one-half reported it has remained the same.

1.2.2 Process Evaluation: Retailer Response to the Lighting Program

Commercial context. It is important to note that, except for lighting specialty stores, sales of lighting products account for a relatively low percentage of total sales revenues for the retailers involved in this program. Thus, for most participating retailers, the perceived importance of promoting efficient lighting products to their overall business success is low. In fact, 75 percent of those interviewed rated the importance of efficient lighting promotion at 2 out of a possible 10.

Promotion. Two-thirds of the retailers interviewed reported that their stores conduct media advertising in support of CFL products, primarily in store circulars or newspapers. Less than half reported undertaking special price promotions for CFL products during the past year, although all reported having permanent in-store advertising for CFL products. It is not clear the how much of this promotional activity was linked to program enrollment and participation.

Program Awareness and Participation. All of the store managers interviewed reported being aware of the EVT program and reported that they had received training from EVT. Moreover, APT records confirmed that the stores were enrolled in the program. However, only 25 percent of the retailers interviewed recalled that they had enrolled in the program. Therefore it appears that most = respondents were confused about their participation status. It appears that some retailers had a difficult time distinguishing between the roles of ENERGY STAR and Efficiency Vermont and which entity operates the rebate program. In fact, some respondents referred to the Efficiency Vermont program as the ENERGY STAR program.

Program Ratings. Retail managers interviewed for this evaluation gave generally high marks to all aspects of the program: assistance with in-store promotion, staff training, and rebate processing. Managers emphasized that EVT staff was accessible and sought out opportunities to work with retail stores on promotions, displays, and bring enthusiasm to the program.

Managers are generally split as to whether the Efficiency Vermont program has affected their stores' stocking and promotion of Energy Star qualified CFL products. Some managers stated their stores had already stocked and sold CFL products on their own. Six of the eight store managers mentioned that the rebates had a large effect on sales. This reported effect is consistent with preliminary results of sales data that suggest large increases in sales from 2000 to 2001.

1.2.3 Residential Lighting Component Conclusions and Recommendations

Conclusions. Overall, the lighting component of the Efficient Products Program appears to be working well. Specific findings in this regard are as follows.

- **High level of retailer participation.** Practically all retail locations in the major categories that sell more than a small selection of light bulbs are participating in the program. These include home centers, chain hardware stores, and discount department stores. The retailer interviews found that half of the sampled managers were unclear as to the sponsorship and operation of the program. This lack of clarity did not seem, however, to affect the key retailer functions of stocking and promotion.
- **Adequate stocking levels.** One year into the program, participating stores carried a sufficient number of qualifying CFL models to support higher level of purchases stimulated by the program.
- **Retailer promotion.** Despite meager commercial interest in CFL products, virtually all participating retailers maintained permanent in-store promotion for them; about half supported CFL products with circulars and media advertising.
- **High level of customer participation.** Over the first two years of operation, 13 – 15 percent of all VT households purchased products through the program, with annualized participation nearly doubling from 2000 to 2001. By way of comparison, between 1991 and 1998, 20.5 percent of residential customers served by the major New England utilities with long-standing residential lighting programs had participated in one of those programs.⁵ The participation rate for a similar program in Long Island was 7 percent during its first year.
- **Rapid take-off for fixture sales.** Compact fluorescent fixtures yield higher unit savings than CF bulbs because they are less likely to be removed from service once installed and because their useful lives can be extended through relatively inexpensive bulb replacement. For a variety of reasons, compact fluorescent fixtures have experienced low sales and market share. Therefore, the share of fixtures among all units sold through the program is an useful indicator of its market effects. In 2001, the program sold over 27,000 fixtures. This was 22 percent of all units subsidized through the program and nearly 8 percent of all lighting fixtures sold in the state. By way of comparison, the Long Island program sold 37,500 fixtures in its first year. That was 10 percent of the units sold through the program and roughly 3 percent of all fixtures sold in the relevant market area.⁶

Issues for further analysis. The results reported above raise a number of evaluation questions, most of which will be addressed through the completion of Phase 1 evaluation activities. These include:

⁵ XENERGY Inc. 1999. *Market Progress Report for Residential Lighting*. Prepared for New England Electric Service, Northeast Utilities, EUA, ComElectric, and Boston Edison.

⁶ XENERGY Inc. 2001. *Residential Lighting Market Baseline Study*. Prepared for KeySpan Energy Services.

- To what extent are contractors using compact fluorescent fixtures in new construction and renovation projects? To what extent are these fixtures being purchased through the program?
- How many unique customers participated in the program?
- To what extent are program participants new adopters of CF technology?
- What is the extent of free ridership among program participants?
- What percentage of products purchased through the program are being reserved for replacements or other future use?

Many of these questions will be addressed by the customer on-site survey and through interviews with builders and remodelers conducted for the new construction program evaluation.

Recommendations. The lighting component of the EPP appears to be operating very well – in fact out-performing similar programs in other New England states. Pending completion of the Phase 1 research and assessment of the additional questions identified above, we have no recommendations regarding changes to the design or implementation of the program.

1.3 APPLIANCE COMPONENT

Changes in ENERGY Star standard. In reviewing the performance of the appliance component of the EPP, it is important to note that the ENERGY STAR standards applied to dishwashers and refrigerators changed significantly as of January 1, 2001. In both cases, the standards became significantly more rigorous, which led to the reclassification of many previously qualified models.⁷

1.3.1 Preliminary Market Characterization

Demand Side: Market Size and Share for ENERGY STAR Products

Table 1-5 summarizes information on current shipment volumes and ENERGY STAR market share for the four appliance categories covered by the program. The table presents ENERGY STAR market share figures from two sources. The first is a sales tracking program sponsored by the U. S. Department of Energy that compiles sales information from six national appliance and department store chains. Only one of these chains – Sears – has locations in Vermont. The second, compiled by the Association of Home Appliance Manufacturers (AHAM), tracks manufacturer shipments to individual states.

⁷ Standards for clothes washers also changed. However, those changes had mostly to do with technical aspects of product testing and did not result in the reclassification of many models.

Table 1-5
Shipments and ENERGY STAR Market Share

		ENERGY STAR MARKET SHARE							
		VERMONT				U. S.			
	VT Unit Ship'ts	Per DOE Reporting			Per AHAM	Per DOE Reporting			Per AHAM
Product	2000	1999	2000	2001	2000	1999	2000	2001	2000
Room AC	8,600	12.2%	22.0%	19.8	n/a	13.3	18.9%	11.5%	n/a
Clothes washer	12,500	21.0%	22.6%	25.1	25.0%	8.5%	9.3%	10.3%	9.6%
Dishwasher	9,700	7.5%	8.1%	14.8	8.2%	12.4	10.9	19.9%	10.7%
Refrigerator	12,000	28.1%	31.0%	14.9	31.2%	24.4	27.0%	17.3%	27.0%

Review of the information in Table 1-5 yields the following key observations.

- Despite its limited sample frame, the DOE reporting system yields market share estimates that are nearly identical to AHAM results at both the state and national level. The higher share of washer shipments in 2000 (versus sales) may reflect manufacturers' anticipation of continued strong demand for ENERGY STAR washers with the continuation of the rebate program.
- Vermont's ENERGY STAR market shares for room air conditioners, dishwashers, and refrigerators track the national figures closely. However, Vermont's market share for efficient dishwashers has been consistently higher than the nation's since 1998. Moreover, the Vermont market share jumped to 21.0 percent in 1999 (compared to the national figure of 8.5 percent), one year prior to the implementation of the rebate program. This suggests strong prior knowledge of and interest in efficient washers among customers.

Market Barriers to Purchase and Promotion of ENERGY STAR Appliances

Recent appliance baseline studies in California and Long Island arrived at very similar findings regarding barriers to increased market share for ENERGY STAR Appliances.⁸ These are as follows.

There is substantial confusion among customers regarding the labeling and identification of efficient appliances. Approximately 90% of all recent appliance purchasers in both studies believed that they have purchased an energy efficient appliance whereas the model number checks found that only 17% of customers had actually purchased an ENERGY STAR model. In

⁸ XENERGY Inc. 2000. *California Statewide Residential Lighting and Appliance Baseline Study*. San Diego Gas & Electric. XENERGY Inc. 2001. *Long Island Residential Appliance Baseline Study*. KeySpan Energy Cor

addition, when asked why they believe their appliance was efficient, 13% cited the ENERGY STAR label (on an unaided basis). Only 17% of ENERGY STAR purchasers and 12% of non-purchasers mentioned the presence of the ENERGY STAR label or materials.

Customers generally do not understand the attributes of efficient appliances. ENERGY STAR purchasers appear to be only slightly more familiar than non-purchasers with the incremental costs and energy savings of ENERGY STAR appliances.

Low priority given to energy efficiency as a product selection criterion. Recent appliance purchasers report placing relatively low value on energy efficiency versus product features and appearance as a model selection criterion. For example, in one recent study, fewer than one-third of recent appliance purchasers reported that energy efficiency was an important consideration in the selection of clotheswashers, dishwashers, or refrigerators.

Incremental costs for ENERGY STAR appliances remain high. Retail floor surveys conducted for Long Island study found that the average incremental cost for ENERGY STAR refrigerators (with otherwise identical features) was \$296; \$119 for dish washers, and \$447 for clothes washers. Floor surveys conducted by APT in Vermont (which do not support statistical control for differences in features) found the following incremental costs for ENERGY STAR appliances: refrigerators - \$453; clothes washers - \$474; dishwashers - \$118. Part of the explanation for the relatively high incremental costs has to do with manufacturers' stated strategy to bundle high energy efficiency with other product attributes for which customers are willing to pay extra: quiet operation; high capacity, advanced controls, and the latest in white goods fashion. This pricing approach may be limiting the segment of customers who would be interested in paying for efficiency differences.

Supply Side: Market Size and Segmentation

Program contractor Applied Proactive Technologies estimates that about 70 retail stores sell appliances products in Vermont. Almost all of these stores are participating in the current Efficiency Vermont appliance program. An analysis of the APT retailer database found that 73 percent of these stores could be classified as independents, 17 percent as national chain outlets, such as Sears, and 10 percent as regional chain outlets.

National sales data collected by TWICE magazine from their Major Appliance Retail Registry indicates that the majority of appliances purchased in the United States are purchased from mass merchants (such as Sears) and electronics/appliance stores (such as Circuit City and Best Buy), as shown in Table 1-6 below.

Table 1-6
Source of Major Appliance Purchases

Store Type	Estimated Major Appliance Sales (in \$ millions)	
	1999	% of Sales
Department	\$14.0	0.1%
Electronics/Appliance	\$4,921.7	39.4%
Home furnishings	\$496.1	4.0%
Home improvement centers	\$1,265.0	10.1%
Mass merchants	\$5,571.0	44.6%
Other types	\$62.8	0.5%
Warehouse clubs	\$160.0	1.3%
Total Registry	\$12,490	100.0%
Source: TWICE, November 20, 2000. Note: Information gathered from the TWICE 2000 Major Appliance Retail Registry, a composition of 100 retail chains.		

The top 5 retailers – Sears, Circuit City, Lowe’s, Best Buy, and Montgomery Ward - comprised about 75 percent nationwide major appliance sales during 1999. Sears alone accounted for roughly 39% of appliance sales. However, Sears is the only one of these retailers with any sort of presence in Vermont.

The majority of appliances purchased in Vermont follow the same sales pattern as mentioned in Table 1-6. According to information collected in the state’s TumbleWash rebate program for the year 2000, mass merchants were the greatest source of sales. The 9 Sears stores enrolled processed the greatest number of rebate coupons (42 percent, see Table 1-7 below). Electronics and appliance stores, the most numerous group in terms of the number of stores enrolled in the program, processed 39 percent of the rebates.

Table 1-7
Clothes Washer Rebates Processed, 2000 by Store Type

Type	# Stores	# Rebates	% Rebates
Mass Merchants	9	733	41.7%
Electronics/Appliance	28	690	39.3%
Service Contractor	9	126	7.2%
Electric/Electrical supply	5	91	5.2%
Other	5	67	3.8%
Hardware/Do-it-yourself hardware	3	43	2.4%
Furniture	3	7	0.4%
TOTAL	62	1757	100.0%
Source: APT, 2001.			

1.3.2 Process Evaluation: Retailer Response to the Appliance Component

Stocking Practices

APT conducts semi-annual sales floor inventories of all retailers that participate in the appliance component of the EPP. These efforts count all units of the four appliance categories on display at the time of the visit and collect information on the price and ENERGY STAR designation of the units. Strictly speaking, this is not a measurement of “stocking” in the sense of inventories ready for customer delivery. Virtually all appliance retailers store inventory for delivery at off-site regional warehouses maintained by national chains or buyers groups. However, according to reports from retailers and APT, the items on the display floor mirror fairly closely the composition of warehouse inventories.

Figures 1-1 and 1-2 display the results of the floor inventories for clothes washers and refrigerators respectively. The fall 1999 inventory was conducted prior to the official launch of the program.

Figure 1-1
Clothes Washer Stocking and Price Trends, Vermont

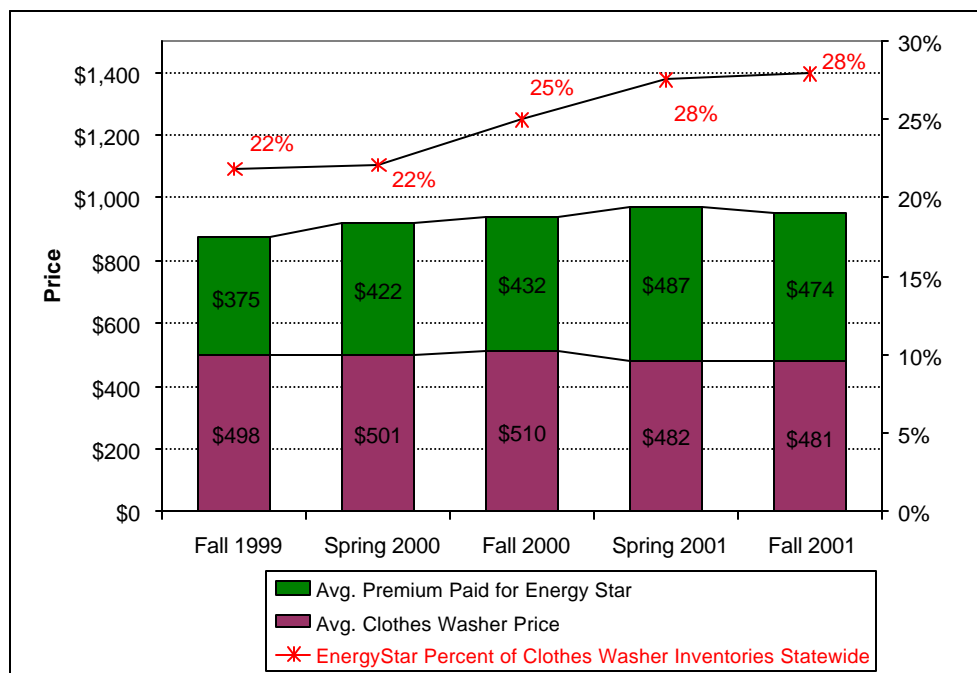
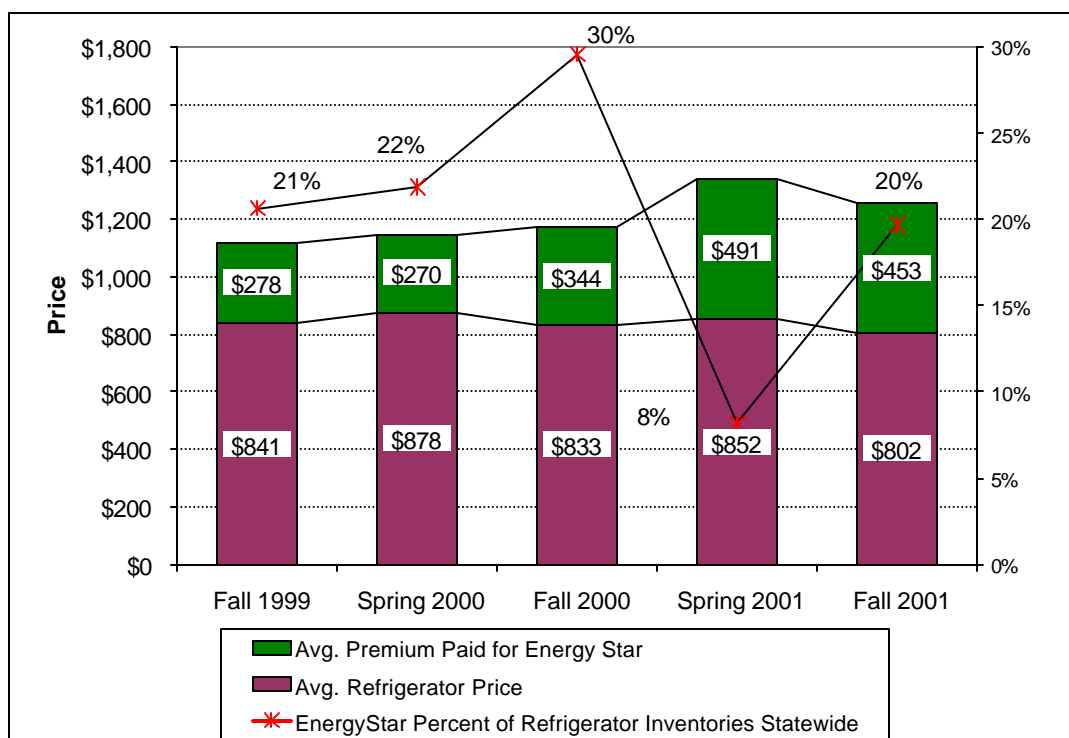


Figure 1-2
Refrigerator Stocking and Price Trends, Vermont



Examination of Figures 1-1 and 1-2 yields the following observations.

- The share of ENERGY STAR-qualified clothes washer models on display increased steadily from 22 percent in the fall of 1999 to 28 percent in the fall of 2001.
- Incremental prices for ENERGY STAR models increased from \$375 to \$474 over the same period.
- The share of ENERGY STAR refrigerators on display increased rapidly from the fall of 1999 through the spring of 2000 – from 21 to 30 percent. With the introduction of new standards in January 2001, the share of ENERGY STAR refrigerators on display dropped to 8 percent. However the share recovered to 20 percent by the fall 2001 inventory, indicating that retailers were adjusting their stocks to reflect the new standards.
- Even before the effective date of the new ENERGY STAR standards, the incremental price of qualifying refrigerators rose from \$278 to \$344 over the course of one year. After the new standards took effect, the incremental price increased sharply to \$491, and receded somewhat to \$453 in the fall of 2001.

Other key observations from analysis of the floor inventories are as follows.

- The share of ENERGY STAR dishwashers on display rose from 31 percent in the fall of 1999 to 41 percent in the fall of 2001.
- The share of room air conditioners qualified for ENERGY STAR dropped precipitously from 23 percent in the spring of 2000 to 7 percent a year later. This development reflects the promulgation of the new ENERGY STAR standards.⁹
- Department stores such as Sears displayed a significantly *lower* percentage of ENERGY STAR clothes washers and dishwashers than independent appliance stores and other kinds of retailers. For example, in the most recent inventory, ENERGY STAR clothes washers accounted for 18 percent of models on display at department stores versus 32 percent at independent appliance stores. On the other hand, department stores displayed a slightly higher share of ENERGY STAR refrigerators than other kinds of stores.

Sales and Promotion Practices

Many studies have found that customers' interactions with sales floor staff have a great deal of influence on appliance selection. Unlike lighting product purchases, retail purchase of appliances generally cannot be accomplished without interaction with sales staff. Given that these are infrequent purchases and that energy efficiency generally ranks low as a model selection criterion, guidance from the sales person is critical to encouraging a customer to select an ENERGY STAR product, particularly given the significant incremental costs of those products.

XENERGY conducted a series of scripted appliance mystery shopper visits to a representative sample of eight Vermont retail locations to gather information on the effectiveness of sales person efforts to promote ENERGY STAR products. All of the sample retailers were participants in the program. Generally, we found that the sales staff effectively promoted ENERGY STAR clothes washers, for which rebates were available, but did little to promote the other appliances addressed by the program. Moreover, their general level of knowledge concerning the meaning and interpretation of the EnergyGuide and ENERGY STAR labels were low, and their representation of various models as ENERGY STAR-compliant was occasionally inaccurate. For example, only 8 percent of the refrigerators that were represented as energy efficient actually qualified for the ENERGY STAR label.

There are a number of potential explanations for the finding that salespersons were much more enthusiastic and effective at selling ENERGY STAR clothes washers than the other covered appliances.

- Resource-efficient clothes washers have been eligible for rebates in Vermont since 1997, whereas other appliances have not been eligible for rebates.

⁹ APT inventories air conditioners only during the spring selling season.

- With recent changes in federal standards, the difference in energy consumption between standard and ENERGY STAR refrigerators and dishwashers is meager. For a 20 cubic foot refrigerator, for example, the difference is only 100 kWh per year, or about \$12 at current rates. The incremental cost for an ENERGY STAR unit, on the other hand, is over \$400. The customer's cost-benefit ratio for purchasing an ENERGY STAR dishwasher is similarly low. In these cases, the salesperson may have already decided that the customer would be better satisfied by spending money on features other than energy efficiency. Annual energy and water cost savings associated with ENERGY STAR clothes washers are significantly higher, although simple payback periods are still in the range of 6 to 8 years.
- Salespeople focused their attention and energy on learning about equipment that was eligible for rebates, which help overcome customer objections to higher initial cost.

Salespersons selling practices seem to be fairly rational, given the low cost-benefit ratio for refrigerators and dishwashers, the dip in ENERGY STAR model availability associated with 2001 changes in standards, and the long-standing availability of rebates for washers. On the other hand, the fairly widespread confusion about the meaning of the ENERGY STAR label, the EnergyGuide label, and qualifying products suggests that salespersons' behavior did not, in every case, proceed from thorough or accurate knowledge of the products and the program.

The performance of the sales persons is not necessarily consistent with the views of store managers concerning the importance of efficient product promotion to overall business success. One-half of the store managers interviewed reported that they thought that promotion of ENERGY STAR products helped bring customers into their stores. A majority of the managers reported that they believed that promotion of efficient products were important to business success. Some of the problems with salesperson performance may be related to high rates of turnover, particularly in large department stores and other "big box" establishments.

1.3.3 Appliance Component Conclusions and Recommendations

Preliminary conclusions. From the information above, we can conclude that EVT and its program contractors have implemented the appliance component of the Efficient Products Program in a diligent manner. Virtually all retail locations that sell appliances have been enrolled in the program. Retailers, for their part, have maintained and in some cases slightly increased display of ENERGY STAR products, in spite of changes in standards for refrigerators and room air conditioners.

At this point in the evaluation, it is difficult to discern a clear pattern of program influence on retailers' promotion and sales practices for products other than clothes washers. In that case, salespersons were clearly well-informed about the benefits of the product, consistently promoted it, and used the availability of the rebate to do so. Lack of similar efforts to promote ENERGY STAR refrigerators, air conditioners, and dishwashers likely reflects some combination of (correct) perceptions of the relatively small savings efficient models generate, high incremental

costs, and lack of available rebates or other incentives to help customers overcome objections to higher first costs.

Rebates for efficient washers appear to have contributed to building and sustaining a market for this product in Vermont. Market penetration of efficient models doubled from 10.5 percent in 1998 (the first full year of the predecessor rebate program) to 21.0 percent in 1999. Since then, the ENERGY STAR market share has gradually increased to 25.1 percent¹⁰, despite steady reduction of rebate amounts from \$150 to \$50. We note, however, that sales of resource efficient washers outside the program appear to have declined. While the number of units rebated through the program increased from 1,972 to 2,719 between 2000 and 2001, total sales of ENERGY STAR clothes washers increased from approximately 2,850 to 3,125. Thus, program sales accounted for 87 percent of total sales of efficient clothes washers in 2001 versus only 70 percent in 2000.

As for dishwashers and refrigerators, the market share of ENERGY STAR models in Vermont was not appreciably different from that of the rest of the nation, at least through the first two years of the program. Vermont's market share for ENERGY STAR room air conditioners in 2001 was considerably higher than the national share: 19.8 v. 11.5 percent. Continued promotion of these appliances may be justified as part of a larger effort to support the ENERGY STAR brand. Recent studies of the national ENERGY STAR communication program show that customer recognition, understanding, and use of the ENERGY STAR in purchase situations is much higher in states where there are active retail promotion programs than in the nation as a whole.¹¹

Key questions for additional research. The results reported above raise a number of evaluation questions, most of which will be addressed through the completion of Phase 1 evaluation activities. These include:

- What percentage of major appliance sales are for replacement versus new construction or major renovation? Previous studies have found that customers purchasing appliances as part of a larger project are frequently less price-sensitive than others and more willing to purchase ENERGY STAR products.
- What is the extent of free ridership among participants in the washer rebate program?
- What program elements might increase salesperson effectiveness in promoting efficient products, particularly refrigerators and dishwashers?

¹⁰ Market share estimates for this Preliminary Report are based on the US DOE reporting system that covers only national chains. Actual market penetration may be slightly higher due to reported higher shares in independent stores. We note, however, that ENERGY STAR models constituted 25 percent of 2000 manufacturer shipments to VT, and that market share of shipments is a good leading indicator of sales.

¹¹ See, for example, Miriam Goldberg et al. 2001. "Counting the Stars in America's Eyes: The Energy Star Household Survey", *Proceedings of the 2001 International Energy Program Evaluation Conference*.

Recommendations. The findings of the Vermont research, as well as those of evaluations of similar appliance programs in other states, suggest that certain issues need to be addressed to improve the performance of the program. These are as follows.

- ***Sales person effectiveness.*** The results of mystery shopper visits in Vermont and elsewhere suggest that salespersons are not taking effective steps to promote ENERGY STAR refrigerators or dishwashers. Offering incentives is cost-effective for clothes washers under current equipment, energy, and water cost conditions. However, the combination of newly-implemented federal product standards and high incremental costs for refrigerators and clothes washer generally reduce the cost-effectiveness of incentives for those products below acceptable levels. Therefore, some other means to motivate sales persons to sell up to higher efficiencies on other products may be required if the program is to have any meaningful impact on the market penetration of refrigerators and dishwashers. This could take the form of a contest or other personal incentive program. Subsequent rounds of process evaluation and program design should address this issue.
- ***EnergyGuide and ENERGY STAR label confusion.*** Some efforts are currently underway at the national level to make the EnergyGuide label easier to understand and to integrate its functions with that of the ENERGY STAR label. EVT and the DPS may want to monitor or become involved in those efforts and ensure that advances in labeling are incorporated into the program.
- ***Efficient Appliance Package for builders and remodelers.*** The Residential New Construction program already includes an incentive for installation of ENERGY STAR appliances in new construction, and major remodeling efforts are eligible for RNC program participation. Energetic promotion of these incentives is likely to be cost effective, since appliance costs are a relatively small portion of new home or renovation project costs.

PRELIMINARY REPORT: RESIDENTIAL NEW CONSTRUCTION PROGRAM EVALUATION

This preliminary report of the evaluation of Efficiency Vermont's (EVT's) statewide Residential New Construction Program has been developed to assist the Department of Public Service (DPS) in meeting its reporting obligations to the Vermont Public Service Board (the Board). Data collection and analysis activities to support the evaluation are in various stages of completion, with delivery of the final Phase 1 evaluation scheduled for September 2002.

The objectives of this report are to:

- Summarize the objectives, activities, and status of the Residential New Construction (RNC) evaluation.
- Present key preliminary findings of the market characterization and process evaluation elements of the evaluation.
- Identify key issues to be examined in the remaining evaluation research and analysis.
- Discuss preliminary recommendations regarding program design and operation that emerge from the analysis completed to date.

2.1 INTRODUCTION

2.1.1 Program Description and Accomplishments through December 2001

Program Objectives. The stated objectives of Efficiency Vermont's Residential New Construction program are to:

- Increase market recognition of superior construction promoted by the pre-existing Vermont Star Home program;
- Increase awareness and compliance with the Vermont Residential Building Efficiency Standard;
- Increase penetration of cost-effective electric and fossil-fuel measures;
- Improve occupant comfort, health and safety;
- Institutionalize Home Energy Ratings, and
- Increase the use of mortgage benefits for energy-efficient homes.

Program Services, Incentives, and Operations. The program offers the following services and incentives.

- ***Eligible projects.*** The program offers incentives for new construction or substantial renovation projects in single-family homes and multi-family residential buildings of three stories or less.
- ***Qualifying standards and incentive levels.*** To qualify for the Vermont Energy Star Home designation, a house must achieve a Home Energy Rating of 86, which is equivalent to the U. S. Environmental Protection Agency's 5-star ENERGY STAR home rating. Generally, homes must contain high levels of insulation, efficient heating and hot water equipment, and high-quality air sealing measures to meet this rating. Homes that score 86 or above in the Home Energy Rating will use approximately 20 percent less energy for heating, cooling, and hot water than those that meet the minimum requirements of Vermont's Residential Building Energy Standard (RBES). In addition to the 86 point home energy rating, qualifying homes will need to feature at least four energy-efficient lighting fixtures in high use areas, hard-ducted returns above the first floor deck, power-vented or sealed combustion equipment, and efficient mechanical ventilation systems.

Builders or owners of Vermont Energy Star homes receive a rebate of \$350 to be applied to the cost of the home energy rating. They may also receive additional rebates up to approximately \$1,300 for installation of efficient lighting fixtures, appliances, and ventilation systems. Additional services available to owners of Vermont Star homes include plan review. Builders who build Vermont Star homes are eligible to participate in technical training programs and receive marketing support for qualifying homes.

Program History and Organization. A consortium of Vermont electric utilities jointly operated a predecessor program known as Vermont Star Homes for more than two years prior to the start up-of Efficiency Vermont. Efficiency Vermont (EVT) contracted with Vermont Star Homes to deliver the EVT residential new construction program, and retained most of its key features. The Vermont Gas utilities offered their own residential new construction (RNC) program known as HomeBase, as did a number of smaller municipal utilities, notably the Washington Electric Cooperative.

The Vermont Star Program began operating under contract to EVT in March 2000. In 2001, EVT and Vermont Gas Systems (VGS) worked together to develop a unified program to be delivered statewide, except in the Washington Electric Cooperative territory. The new program went into effect January 1, 2002, with a six month transition period during which builders will have the option to participate in the existing Vermont Star and HomeBase programs, or in the new program.

The new program – Vermont Energy Star Homes – will features revised qualifying standards and rebate structures, as well as additional services to participating builders. Proposed new services to builders will include a free energy efficient rating (versus the current reimbursement system),

ENERGY STAR certification, possible assistance in filing for Vermont energy code compliance, and a model home marketing package.

Program Accomplishments through December 2001. In its first 10 months of operation, the program issued 323 rebates for home ratings: 106 of them for homes qualifying for Vermont Star designation; the remainder for the Vermont Advantage designation. The Vermont Advantage standard was lower than the Vermont Star requirements and was eliminated from the program. An additional 192 customers had received rebates for specific measures.

In 2001, the program accomplished the following.

- ***Builder participation.*** 85 builders participated in the program in 2001, including 40 who had not participated in the previous year.
- ***Volume of participation.*** 699 construction projects applied for program assistance; 622 were completed.
- ***Vermont Star designation.*** 193 of the completed construction projects received Vermont Star Designation.
- ***Other Measures.*** 429 of the participating homes installed energy efficiency measures under the program but did not apply for or receive Vermont Star designation.

2.1.2 Phase 1 Evaluation Objectives and Status

Program Impact Assessment. The key Phase 1 research questions in regard to program impact are as follows.

1. ***Baseline.*** To what extent are the construction practices required by the programs used by participant builders, nonparticipant builders? To what extent did participant builders use those practices prior to program enrollment?
2. ***Spillover.*** To what extent are the construction practices required by the programs used by participant builders (in homes that do not go through the program), nonparticipant builders? To what extent did participant builders use those practices prior to program enrollment?
3. ***Attribution of adoption of efficient building practices to program influence.*** To what extent do participant builders attribute changes in construction practices to information and experience gained through the program? To what extent do nonparticipants attribute changes in construction practices to program influences? (Untracked savings)

Market Characterization. The key research questions in regard to market characterization are as follows.

1. How large is the residential new construction market? What are its characteristics in terms of distribution by region, price, type of home (primary residence v. vacation), mode of construction (custom v. production v. owner-built v. condominium) and features such as heating fuel?
2. How large is the remodeling market? To what extent are energy efficiency practices employed in remodeling projects?
3. To what extent and through what mechanisms do the following sets of market actors affect builders' decisions regarding energy efficient construction: HVAC and other trades contractors, home energy rating services, industry associations, lenders?

Process Evaluation. The key research questions in regard to process evaluation are as follows.

1. What factors in program design and implementation, if any, account for regional differences in the level of builder participation in the program?
2. What are Vermont Star Home participants' key motives for enrolling; why do nonparticipants stay away?
3. What program elements do builders and homebuyers find most useful?
4. What incentives or information could convince builders to implement the Vermont Star standards on a larger percentage of homes?

Status of Evaluation Activities. Table 2-1 summarizes the research and analysis activities for Phase 1 of the EPP evaluation. All data collection for the supply side analysis is complete. Analysis of all supply side data is complete with the exception of the remodeler interviews. Analysis of the customer telephone interviews is complete, and we are awaiting the completion of on-site survey data collection and analysis by West Hill Energy and Computing.

Table 2-1
Summary and Status of EPP Phase 1 Evaluation Activities

TASK/ Objective	Description/Sample Approach & Size	Status
SUPPLY-SIDE ANALYSIS		
<i>Builder Survey</i>	Probe current practices in regard to energy efficient construction and marketing, code compliance, program effects, perceptions of program, customer demand, value of energy efficiency. Also split of work between new construction and renovation, geographic scope of activity. Random sample of 70 builders with quotas for 2 geographic zones, allocated by location of firms in the zones, with probability of selection proportional to size as measured by # of employees reported to Dun & Bradstreet	Done, 54 completes
<i>Remodeler Survey</i>	Probe the same topics as builder survey. Also, explore opportunities and interest in potential retrofit measures and programs. Random sample of 35 remodeling contractors, with quota for kitchen remodelers. Sampling procedure similar to builder survey	Done
<i>In-depth Interviews with Other Market Actors</i>	In-depth interviews with HVAC contractors, real estate agents, and lenders to probe influence on energy-related construction decisions; adoption of energy efficient practices, perception of builder practices, demand. 30 interviews in all, with samples systematically selected to provide representation for key subgroups and all geographic regions.	Done
DEMAND-SIDE ANALYSIS		
<i>Telephone Survey of Recent Homebuyers</i>	Closed-ended survey to probe customer experience with builders, knowledge of programs, codes and energy efficiency measures. Recruit for on-site surveys. Random sample of 200 with geographic quotas. Sample frame developed from analysis of "Grand Lists" prepared by cities and towns for use in statewide property tax assessment and collection.	Done
<i>On-site Customer Survey</i>	Assess "as built" adoption of efficient construction practices and products. Probe customer awareness and perception of value of energy efficient construction; experience with builder promotion of energy efficiency, awareness of program. Random sample of 130 with geographic quotas	In field as of April 2002. Scheduled completion in June

2.2 PRELIMINARY MARKET CHARACTERIZATION

2.2.1 Demand Side: Size and Segmentation

Estimate of number of homes completed in 2001

Vermont municipalities do not conduct health and safety inspections of single-family homes; nor do they issue occupancy permits. Thus, estimates of the number of new homes built need to be developed indirectly from statistical systems that do not directly track construction activity. The

most comprehensive source of information on property dispositions and type are the “Grand Lists” that each town compiles to support the assessment and collection of the statewide property tax. The Grand Lists contain information on each land parcel in the town, including address, use category, improved/unimproved status, assessed value, and identifying information of property owners. By changes in use designation and assessed value from one year to the next, it is possible to compile a list of properties on which new home construction *is likely* to have occurred. Most Vermont towns now provide their Grand Lists directly to the Vermont Department of Property Tax Valuation in electronic format.

Each municipality is required to file a Form 411 each year with the Vermont Department of Property Tax Valuation. The form lists the total number of buildings in various use categories. Comparing the number of buildings in each category from one year to the next provides a rough estimate of the number of single-family homes, vacation homes and condos built in the town each year. Using the Form 411 data, the Department estimated that 2,300 single family homes and 500 condo units had been built in 1999.

To develop the telephone sample, West Hill Energy & Computing and XENERGY worked directly with the Grand Lists from 230 of Vermont’s 260 towns, as well as with other kinds of lists provided by some of the remaining towns. This provided us with an opportunity to develop an independent estimate of the number of new homes built using various data cleaning rules and the results of screening questions at the beginning of the telephone survey. Using these methods, we estimate that the number of new year-round housing units completed in Vermont in 2001 was considerably lower than would be suggested by analysis of the Form 411s. Specifically, we estimated the number of new homes one- or two-family homes built in 2001 at 1,711, with a 95 percent confidence interval of +/- 5 percent. The major causes of attrition from the sample frame were 1) that the homes in question were actually completed prior to 1999, that they were in buildings with 3 or more units, or that they were used for non-residential purposes.

Geographical Distribution of New Construction: Regional Housing Markets

Housing market observers and participants interviewed identified a number of distinct regional housing markets within the state. These markets are characterized by differences in economic drivers and conditions, pricing, construction approach, and the population of builders. The following paragraphs identify the regional markets and compile some of the comments we received from market observers regarding the differences between them.

- ***Northwestern Vermont.*** (Chittenden, Franklin, Lamoille, Grand Isle, and Washington Counties) Northwestern Vermont – especially the Burlington area -- is home to the highest levels of economic and housing growth in the state. In 2000, area of the state accounted for 48 percent of new housing units built and 73 percent of Vermont Star homes. This is the home region for both EVT and Vermont Gas Systems.
- ***Southwestern and South Central Vermont.*** (Bennington, Rutland, and Addison Counties) This region of the state contains many of its major ski areas. The Manchester and Rutland areas have experienced rapid economic growth, as well as an increase in

resort development and construction of large custom and vacation homes. Builders in Rutland County have participated relatively heavily in the Vermont Star program. It accounts for 5 percent of 1999 new construction versus 9 percent of program participation through May 2001.

Table 2-2
Distribution New Housing Units and Vermont Star Homes (2000)
By Regional Housing Market Area

Housing Market Area	% of all Housing Units*	Percent of Vermont Star Homes
Northwest	48%	73%
Southeast	21%	9%
Southwest/South Central	17%	17%
Northeast	14%	14%

* Based on distribution of new housing units estimated from Forms 411.

- **Northeastern Vermont.** (Essex, Orleans, and Caledonia County) Known locally as “the Kingdom”, this is the least economically developed area of the state. It is primarily rural and characterized by a high percentage of low-income households. One market observer noted that a significant portion of new homes in the region are likely to be built by non-professional owners, that a relatively low percentage of the region’s builders are licensed, and that many are trained through informal apprenticeships that may reinforce traditional building techniques.
- **Southeastern Vermont.** (Windham, Windsor, and Orange Counties) This is also rather economically depressed, similar to the northeastern portion of the state. As noted above, the South also has no active homebuilders association, fewer code workshops and seminars.

Custom v. Production v. Self-Built Homes

Purchasers of new homes may have more or less input into the design and energy characteristics of a home, depending on the nature of their involvement in the process. Table 2-3 summarizes the circumstances under which sample homeowners built or acquired their houses. The general results of this line of questioning suggest that owners and purchasers of new homes in Vermont are much more involved in construction decisions than their counterparts in other states. For example, twenty-two percent of the respondents reported that they themselves built the houses they were living in. Sixty-two percent of the respondents reported that they had purchased custom homes, i.e.: homes built according to plans developed exclusively for them by their builders or architects. By way of contrast, the corresponding figure in New Jersey was 16 percent in 1999. Spec homes – that is homes completed entirely prior to customer purchase – constituted only 6 percent of the houses purchased by the respondents.

Table 2-3
Type of Home (n=200)

Circumstances under which house was built & purchased	%
House built by contractor – not the occupant	78%
Respondent was builder/occupant	22%
Custom home: built to plans developed specifically for the owner	62%
Manufactured Home: assembled on site from pre-fab modules	16%
Semi-custom Home: built to existing plan modified to owner's needs	15%
Spec Home: completed entirely prior to purchase	6%
Other	1%

2.2.2 Buyer participation in energy-related equipment selection and construction decisions

Building a house entails dozens of decisions that contribute to the energy efficiency of the finished product. The homeowner questionnaire contained extensive sequences to elicit the respondents views regarding the extent of their involvement in selection of specific construction features and equipment and the kinds of recommendations they received from builders, contractors, and salespersons involved in the purchases.

Shell and HVAC features. Table 2-4 shows a significant range of owner involvement in the selection of shell and HVAC features. Fifty-eight percent of owners reported that they selected the type of heating equipment installed in their homes with little input from the builder or contractor. The corresponding figure for windows was 37 percent; for insulation 20 percent. Fifty percent reported that they were not involved at all in decisions regarding insulation levels and 39 percent were not involved at all in the selection of windows.

Table 2-4
Decision Makers: Shell and HVAC Features

	Windows	Insulation	Heating System	CAC**
Owner decided on feature – little builder input	37%	20%	58%	17%
Owner gave input to builder/received input	23%	29%	17%	8%
Owner not involved in decision	39%	50%	24%	75%
Not Sure	1%	1%	1%	-
Major Influencer	Builder	Builder	HVAC Contractor	Builder
Recommended energy-efficient option	90%	n/a	59%	n/a
Selected energy-efficient option*	87%	floor - 21% ceiling – 56%	54%	50%

* Self-reported by respondent.

** Only 12 of 200 respondents reported that they installed central air conditioning.

Where owners sought advice on feature and equipment selection, they turned most often to the builder (or HVAC contractor in the case of heating systems). Builders/contractors recommended

energy-efficient windows in 90 percent of such cases and efficient heating systems in 59 percent of the cases. Among the respondents who reported discussing insulation levels with their builders, over half discussed adding insulation above minimum standards.

Appliances. Table 2-5 summarizes information concerning purchase of major appliances for the respondents' new homes. The key points to be made in this regard are as follows.

- In a significant percentage of cases, ranging from 17 percent for refrigerators to 34 percent for clothes washers, respondents did not buy new units for their homes.
- Owners were the sole decision makers in roughly three-quarters of all appliance purchases associated with the completion of their new homes. They had input to the selection in most other cases.
- Owners reported purchasing their appliances through standard retail channels. In most cases, owners reported no outside influence on their equipment selection. However, where such influence was acknowledged, it mostly came from appliance sales persons.
- Appliance salespersons reportedly recommended efficient products in 55 percent to 67 percent of cases, depending on the type of equipment. Efficient clothes washers were recommended most often, perhaps reflecting the availability of rebates through the Efficient Products Program.

Table 2-5
Decision Makers: Appliances

	Refrigerator	Dishwasher	Clothes Washers
Did not buy new equipment for home	17%	21%	34%
Owner Decided	61%	58%	54%
Owner gave input to builder/received input	17%	15%	9%
Owner not involved in decision	5%	7%	3%
Major Influencer	Appliance Salesperson	Appliance Salesperson	Appliance Salesperson
Recommended energy-efficient option	57%	55%	67%
Selected energy-efficient option*	54%	48%	50%

Lighting fixtures. Key findings in regard to selection of lighting fixtures are as follows.

- Seventy-nine percent of respondents reported that they personally selected the permanent lighting fixtures installed in their homes.
- The mean number of fixtures purchased was 18.
- Among those who selected their own fixtures, 47 percent reported that they installed at least one energy-efficient fixtures.¹
- The mean share of fixtures reported as energy-efficient was 35 percent.

¹ "Energy-efficient fixtures" were not specifically defined in the questionnaire.

- Almost all fixtures were purchased through retail channels, with the highest portion of respondents mentioning home centers (60 percent) and lighting specialty stores (40 percent) as the sources of their fixtures. Only 12 percent of respondents mentioned selecting fixtures from catalogs provided by the builder.

2.2.3 Homeowner Knowledge, Attitudes, Values Concerning Energy Efficiency

The homeowner questionnaire contained a variety of items that probed respondents' knowledge of energy efficiency issues in regard to housing, the values they associated with energy efficiency, and the priority of energy efficiency in selecting builders, homes to purchase, and equipment. While the results of these items were consistent with other studies in that they generally reveal low interest and priority in energy efficiency in regard to such key decisions as the selection of a builder, overall home design, and energy code compliance. However, respondents did attribute high importance to energy efficiency in the selection of appliances and various construction features.

Specific findings in regard to customer knowledge and attitudes are as follows.

- ***Consideration of energy efficiency in selection of builder and home.*** When asked for the reasons they selected their builder, respondents mentioned recommendations from friends and relatives most frequently (28 percent) followed by favorable impressions of homes they had seen (25 percent). Only 2 percent mentioned the availability of energy-efficient options as reasons for selecting a builder. Eighteen percent of respondents who purchased completed homes mentioned energy efficiency as one reason for the selection of that home.
- ***Search for information on energy efficiency.*** Nearly half of all respondents (48 percent) reported that they sought out information on energy efficiency options from builders or third parties in the course of construction. Thirty percent report receiving estimates of the annual energy consumption. More than half of these respondents were participants in the Vermont Star Home or HomeBase programs.
- ***Values associated with energy efficiency.*** Seventy-six percent of respondents mentioned reduced energy costs as a benefit of energy efficient homes. Twenty-two percent mentioned environmental benefits, and eight percent mentioned increased comfort.
- ***Energy efficiency as equipment selection criterion.*** Energy efficiency was mentioned most frequently of all criteria for the selection of clothes washers (31 percent) and dishwashers (33 percent). Energy efficiency was mentioned as a selection criterion by 39 percent of refrigerator purchases, exceeded only by size/capacity (55 percent).
- ***Awareness of the Residential Building Energy Standards.*** Homeowner awareness and understanding of Vermont's residential energy code is sketchy, particularly among those who bought as opposed to built their own homes. Only 24 percent of "buyers" reported that they were aware of the RBES, versus 44 percent of "builders". Nonetheless, 51 percent of buyers believed that their homes complied with RBES, and 28 percent

claimed, at the end of the question sequence, to have a certificate of compliance. Only 16 percent of the “builders” claimed to have a certificate of compliance. This pattern of response is consistent with the results of other homeowner studies that find that homeowners – and especially purchasers of new homes – believe that their houses are energy efficient, whether or not they have evidence to support that characterization. These beliefs may act barriers to programs designed to induce further efficiency improvements in existing homes.

2.2.4 Program Awareness and Participation

Programs. It is important to recall, in interpreting survey results on homeowner recognition of various programs, that most of respondents completed the construction of their homes before the end of 2000. At that point such programs as Vermont Star Homes, HomeBase, and Energy Rated Homes of Vermont had been in operation for many years, whereas Efficiency Vermont had only been in operation for a year.

The majority of new homeowners were unfamiliar with most programs—or at least with the names or sponsors of the programs. For example, 19% of respondents had heard of “Efficiency Vermont,” although 35% said they were aware of the rebates available through the program.

A majority of new homeowners were unaware of the Vermont Star Home program.

- 39% had heard of the “Vermont Star” or the “Vermont Star Home” program;
- 21% of buyers had discussions about building their home to the VT Star Home standard;
- 11% of respondents indicated that they had a Vermont Star Home; one was a Vermont Advantage Home. In 2000, roughly 6 percent of homes completed in Vermont received Vermont Star designation, so these homes were somewhat overrepresented in the sample.

Home Energy Ratings. A surprisingly large portion of homeowners – 78 percent -- reported that they had heard of home energy rating services. Twenty-four percent of respondents reported that they had received home energy ratings. Roughly one-half of these would have been provided as part of participation requirements in the Vermont Star program.

2.3 THE SUPPLY SIDE

The process of building and selling new homes involves many groups of market actors: builders, trades contractors, materials suppliers, real estate agents, appraisers, and lenders. However, residential new construction market assessments and program evaluations show consistently that the builder is responsible for most of the decisions that affect the energy efficiency of a home. Builders also have the most at stake in such decisions in terms of their effects on costs, profits, reputation, and ability to market current and future construction projects. Thus, most of the efforts of the RNC focus on providing builders with incentives to adopt energy efficient

construction practices, such as rebates for home energy rating fees and specified products, training (to reduce the information costs of learning new techniques), and marketing support. Likewise, the Phase 1 evaluation efforts focused heavily on characterizing Vermont's home builder market, current construction and marketing practices, and program effects on those practices.

2.3.1 Home Builders: Market Size and Segmentation

The Population of Builders. To develop a preliminary profile of the population of Vermont builders, XENERGY analyzed establishment data from Dun & Bradstreet contained in the iMarket database. In a number of recent studies, we have found that builder lists developed from this source are generally accurate in two key respects. First, virtually all of the firms or individuals contacted did report that they had built single and/or multifamily homes in the past two years. Second, their classification by number of employees tended to be accurate. As discussed in the section on homeowners, not all Vermonters who actually build homes will classify themselves as builders. However, we use this relatively accessible source as a place to start. Key findings from the analysis of the Dun & Bradstreet data are as follows.

- **Number of establishments.** The number of establishments that claim single-family home construction as their primary line of business is very large in comparison to the number of homes built. Specifically, there are 560 such establishments versus 1,700 to 2,000 single-family homes built per year. By way of contrast, there are 1,670 builders listed in New Jersey with an annual construction total of 30,000 units.
- **Size distribution of establishments.** These establishments are generally very small. Seventy-six percent of all builders employ fewer than 5 persons. Thirty-one percent are one-person operations.
- **Market share by size of firm.** Preliminary estimates suggest that builders in the mid-size range (5 – 24 employees) are responsible for construction of roughly 60 percent of units in buildings with fewer than 3 units. Small builders (1-4 employees) account for about 20 percent of the market. Builders with more than 25 employees, of which only 9 were listed by Dun & Bradstreet, account for the remainder.
- **Geographic distribution.** The geographic distribution of the listed builders by county mirrors almost exactly the county distribution of new home construction. This finding may imply that home building is very much a local activity in Vermont. Respondents representing sixty-nine percent of construction volume report working exclusively in Vermont. The remainder do some work in neighboring states.
- **Single-family home building as secondary activity.** The Dun & Bradstreet data collection form allows establishments to identify up to three business areas in which they are active, in addition to their primary SICs. These data suggest that there are at least 70 establishments involved in single-family home construction in addition to those that claim that line of business as their primary SIC. In the sample, respondents representing 68 percent of construction for small builders reported that they did remodeling work as

well.² The corresponding figures for medium-sized builders was 37 percent. All large builders in the sample reported doing remodeling work as well as residential new construction.

- **Home Characteristics.** Each survey respondent was asked to indicate the percentage of housing units they built in 2001 that fell into several categories. This information is summarized in Table 2-6. Note that multi-family homes account for a far greater proportion of homes built by large builders than by small builders, and that large builders account for a greater proportion of vacation homes, custom homes, and homes built through affordable housing programs than builders in the other size categories.

Table 2-6
Mean Percentage of New Housing Units with Particular Characteristics

Characteristic	Builder Size			Overall
	Small	Medium	Large	
Single Family Homes	91%	91%	18%	83%
Two Family Homes	9%	9%	< 1%	8%
Multiple Family Homes	< 1%	< 1%	82%	9%
Built for Year-Round Occupancy	96%	86%	70%	89%
Custom -Built Homes (refers to single-family only)	85%	51%	100%	69%
Built Through Affordable Housing Programs	< 1%	< 1%	23%	3%

- **Sales Prices.** The mean price reported for custom-built units in Vermont in 2001 was approximately \$475,152 while the mean price reported for production homes was \$279,258.

2.3.2 Baseline Construction Practices

The builder survey contained a series of questions probing whether respondents included certain energy-efficient features as standard in their homes, offered them as an option, or generally did not offer them. To help assess the plausibility of builder self-reports, we also present the relevant results of a 1995 baseline construction study, based on inspections of 155 recently constructed homes. While interpretation of the 1995 survey is clouded by problems in the sample design, it does offer one point of comparison. The on-site survey currently in the field will provide a more recent and representative set of results.

² In analyzing the results of the builder survey, XENERGY used a combined ratio estimation process that yields results in terms of the percentage of total single- and two-family homes built that is represented by builders in a given category. We believe this approach more accurately conveys the prevalence of various practices and attitudes than simple weighted proportions or sample means.

Table 2-7
Indicators of Baseline Construction Practices:
Current Self-Reported Builder Offerings and 1995 Baseline Inspection Results

Feature	Builder Survey Results			1995 Baseline
	Standard	Option	Not Offered	
Low-e windows	94%	6%	-	71%
Argon-filled windows	76%	21%	3%	38%
Basement insulation above R-10	72%	27%	1%	48%*
Wall insulation above R-19	56%	41%	3%	67%*
Attic insulation above R-38	55%	38%	7%	61%*
Floor insulation greater than R-10	31%	38%	31%	n/a
Home orientation to take advantage of solar gain	51%	22%	27%	n/a
ENERGY STAR high-efficiency HVAC equipment	65%	20%	15%	n/a
Advanced controls (i.e., fan timers, programmable thermostats)	51%	28%	21%	17%
Reduced air infiltration measured using blower door equipment	47%	15%	37%	n/a
ENERGY STAR high-efficiency appliances	31%	26%	43%	n/a
Duct sealing and leakage testing	21%	31%	48%	n/a
ENERGY STAR hard-wired compact fluorescent lighting fixtures	20%	57%	24%	34%

* Percent of sample homes meeting criterion.

Key results of the builder survey in regard to current construction practices are as follows.

- **Windows.** Almost all builders offer low-e windows as standard equipment. Builders representing 76 percent of construction activity offer argon-filled windows as standard equipment. These results are consistent with trends that were apparent in 1995. They are also consistent with recent window market assessments that have found high penetration of ENERGY STAR windows in new construction.
- **Insulation.** Builders representing the majority of new homes built report that they install insulation to levels above those required for compliance with RBES. Most of the remaining builders report offering insulation beyond RBES requirements as an option. Again, this pattern is consistent with observations made during the 1995 baseline.
- **Appliances.** As discussed above, builders purchase appliances in only a small percentage of new homes they build. However, the report of 31 percent offering ENERGY STAR appliances as standard equipment and 26 percent as an option would be consistent with the overall market share of ENERGY STAR equipment in the state.
- **HVAC Equipment.** Respondents representing nearly two-thirds of new construction volume reported that they offer ENERGY STAR HVAC equipment as standard equipment. This level of market penetration is far higher than would be suggested by ARI shipment data, interviews with Vermont residential HVAC contractors interviewed for this evaluation, or market studies of other states. Thus, we believe this result stems from

misunderstanding of the ENERGY STAR standards, since responses to most of the other items seem consistent with information from other sources.

- **Infiltration.** Reported use of blower door tests is very high. Builders representing 47 percent of new units claim to do such tests as standard procedure. This result is inconsistent with much lower reported use of home energy rating services. On the other hand, the 1995 baseline found very low average levels of infiltration in the sample homes.

2.3.3 Awareness of and Compliance with RBES

Residential Building Energy Standards (RBES). Approximately 85 percent of new homes built in Vermont in 2001 were built by builders who indicated that they were aware of the RBES. However, of the builders who reported they were aware of the RBES, those who posted certificates of compliance (as required by the RBES) represent only 37 percent of the construction conducted by builders who were aware of the code. These results are completely consistent with experience reported by homeowners.

Builders were asked to identify, without prompting, home features that were required by the RBES. Table 2-8 shows the percentage of new construction volume represented by builders who were able to name particular features necessary for compliance, by feature and size of business. Builders representing more than three-quarters of new homes built in 2001 were familiar with attic and wall insulation levels required to meet RBES standards. However, beyond insulation, the percentage of builders who were able to name required efficiency features dropped off quickly. Moreover, large builders who specialized in multi-family homes and larger developments appear to be very much in the dark concerning provisions of the RBES.

Table 2-8
Unaided Recall of Features Necessary for RBES Compliance, by Feature and Size
(Weighted by Volume of New Homes Built)

Feature	Builder Size			Overall
	Small	Medium	Large	
Attic insulation at least R – 38	73%	82%	12%	77%
Wall insulation at least R-19	72%	83%	24%	77%
Argon-filled windows	28%	72%	< 1%	53%
Basement insulation at least R-10	63%	32%	24%	44%
Low-e windows	57%	31%	< 1%	40%
Floor insulation at least R-10	45%	29%	< 1%	35%
High efficiency heating and cooling equipment	36%	25%	< 1%	28%
Reduced air infiltration	43%	13%	< 1%	24%
Mechanical ventilation	36%	6%	< 1%	17%

2.3.4 Energy Efficiency Marketing Practices

The builder survey contained a number of questions concerning the respondents' efforts to inform customers about the energy aspects of their homes and to promote the inclusion of efficient features. In interpreting the results of these questions, we were particularly interested to compare builder reports of their own practices to homeowners' impressions. The key results of this analysis are as follows.

- **Discussion of energy efficiency benefits in the design phase: custom homes.** Builders representing 82 percent of custom home construction reported that they discussed the benefits of energy efficiency with customers in all cases; an additional 10 percent reported doing this in most cases. By way of contrast, 48 percent of homeowners interviewed reported having such discussions. Builders representing 90 percent of construction volume reported that they mentioned reduced energy costs as a benefit of energy efficiency, and more than 20 percent mentioned additional benefits including increased comfort, reduced maintenance costs, and reduced environmental damage. These levels were slightly higher than those recalled by customers.
- **Provision of energy consumption estimates.** Builders representing 30 percent of construction volume reported that they developed estimates of energy consumption for new homes in all or most cases. Builders representing 26 percent of construction volume reported preparing such estimates in some cases. These responses are consistent with the experience reported by homeowners, 30 percent of whom reported receiving an energy consumption estimate for their homes.

2.4 PROCESS EVALUATION

2.4.1 Builder Awareness of Efficiency Programs

As Table 2-9 shows, builders representing 95 percent of construction volume were aware of the Vermont Star Homes program. Of these, builders representing about a quarter of the state's new construction participated in the program in 2001. Levels of awareness and participation for Vermont Star Homes were significantly higher than they were for HomeBase or the Washington Electric Coop programs.

Awareness and participation in Vermont Star Homes varied greatly among regions. As Table 2-10 shows, awareness of the program is almost universal in the Northwest, Southeast, and Southwest market areas. However, builders representing only 11 percent of construction volume in the Northeast region reported being aware of the program. Participation is particularly strong in the Southwest market area, where builders representing 39 percent of the region's construction volume report that they participated in the program.

Table 2-9
Builder Recognition of and Participation in Energy Efficiency Programs
(Weighted by Volume of New Homes Built)

Program	Aware				Participated (Of Those Aware)			
	Small	Medium	Large	Overall	Small	Medium	Large	Overall
Vermont Star Homes Program	88%	100%	100%	95%	14%	19%	76%	24%
HomeBase Residential New Construction Program	6%	74%	< 1%	35%	< 1%	19%	-	18%
Washington Electric Coop Residential New Construction Program	53%	55%	< 1%	48%	20%	6%	-	13%
Overall	49%	76%	33%	59%	*			

* Data unavailable (each program queried separately).

Table 2-10
Builder Recognition of and Participation in Energy Efficiency Programs by Region
(Weighted by Volume of New Homes Built)

Program	Aware					Participated (Of Those Aware)				
	NW	NE	SE	SW	Overall	NW	NE	SE	SW	Overall
Vermont Star Homes Program	98%	11%	90%	100%	95%	23%	< 1%	14%	39%	24%
HomeBase Residential New Construction Program	39%	< 1	37%	19%	35%	23%	-	< 1%	< 1%	18%
Washington Electric Coop Residential New Construction Program	55%	89%	10%	46%	48%	5%	100%	< 1%	27%	13%
Overall	64%	33%	46%	55%	59%	**				

* Data unavailable (each program queried separately).

2.4.2 Vermont Star Homes Program: Participant Response

General Characteristics. The 12 builders who reported participating in the Vermont Star Homes Program completed a total of 155 homes in 2001. They reported receiving program certification for 88 of these homes, or 57 percent of the total number of homes built.

Influences on Participation. Builders who account for approximately 42 percent of Vermont's 2001 new construction volume indicated that direct mailings or other materials received from the Vermont Star Program staff was an influential source of information on the Vermont Star Homes

Program (Table 2-11). Builders representing just over one-third of the state's 2001 new construction indicated that trade or professional organizations had made them aware of the Program.

Table 2-11
Sources of Information on the Vermont Star Homes Program by Builder Size
(Weighted by Volume of New Homes Built)

Feature	Builder Size			Overall
	Small	Medium	Large	
VT Star Home Direct Mail, Other Materials	58%	70%	4%	42%
Other Trade Or Professional Organizations	< 1%	< 1%	91%	34%
Home Builders Associations	5%	83%	< 1%	32%
Potential Homebuyers	27%	< 1%	6%	9%
VT Star Home Program Staff	10%	4%	< 1%	4%
Efficiency VT Program Staff	10%	< 1%	< 1%	3%
Average	12%	19%	22%	18%

Reasons for Participation. Builders representing approximately 30 percent of Vermont's new construction in 2001 indicated that their primary reason for participating in the Vermont Star Homes Program was to get marketing support and receive additional publicity for their companies. Also mentioned were rebates, general environmental concerns, and the impression that participation would increase the builder's credibility.

Table 2-12
Reasons for Vermont Star Homes Program Participation by Builder Size
(Weighted by Volume of New Homes Built)

Feature	Builder Size			Overall
	Small	Medium	Large	
Get Marketing Support, Extra Publicity For The Company	27%	62%	< 1%	30%
Get Rebates	< 1%	17%	< 1%	6%
Customers are for Environmental / Efficiency Info About Homes	< 1%	13%	< 1%	5%
Wanted To Learn More About Efficient Building Techniques	10%	< 1%	< 1%	3%
Generally Think That Environmental Issues Are Important.	< 1%	8%	< 1%	3%
Help Market The Houses That Get Labeled	< 1%	< 1%	4%	1%
Distinguish Company From Competitors	5%	< 1%	< 1%	1%

Marketing and Selling Vermont Star Homes.

- **Effects of program requirements on construction costs.** Builders representing approximately 56 percent of the 2001 new home volume indicated that installing features required to gain certification from the program resulted in added construction costs compared to homes without those features. These added construction costs averaged approximately \$6,766 and ranged from \$1,000 to \$20,000. Builders indicated that it was difficult to estimate added construction costs because these costs depend largely on general home characteristics, particularly size; for example larger homes would generally incur higher additional construction costs to include features necessary for certification than would a smaller home.
- **Effects of program certification on salability.** Builders representing approximately 53 percent of participants' new construction volume indicated that they were able to sell certified homes more easily than uncertified homes built during the same period.
- **Effects of program certification on sales prices.** Builders representing approximately 74 percent of participants' construction volume indicated that they were able to obtain a higher selling price for homes certified through the program. Most builders were unable to indicate the average increase in selling price for certified homes, stating that the price increase generally depends on the general desirability of the home (size, location, etc) before considering efficient construction or features. Of those who were able to indicate a price increase, this ranged from \$4,000 to \$20,000 and averaged approximately \$7,815.

2.4.3 Vermont Star Homes Program: Nonparticipant Response

Familiarity with Program. Thirty-eight of the builders who indicated that they'd heard of the Vermont Star Homes program answered a series of questions about the construction and equipment features required for the program. Of these, builders representing approximately 17 percent of nonparticipants' construction volume were unable to list any features required for homes to be certified through the program. Among builders who were able to name at least one required feature, low-e windows were mentioned by those representing nearly half of the new construction volume.

Familiarity with Services and Marketing Support. Non-participating builders representing approximately 74 percent of nonparticipants' construction volume indicated that they were familiar with the services and marketing support offered by the Vermont Star Homes Program, and builders representing the remaining 26 percent indicated that they were at least somewhat familiar. Builders representing approximately 13 percent of the nonparticipants' construction volume were unable to name any of these services, but the remaining were able to recall at least one, including Energy Star certification, financial incentives, and marketing assistance.

Reasons for Nonparticipation. Non-participating builders representing approximately 28 percent nonparticipants' new construction volume indicated that their primary reason for non-participation was that they had no trouble selling their homes without the Program's assistance.

Other reasons mentioned include the following:

- The belief that customers have no interest in energy efficiency;
- The impression that they would be unable to recover costs necessitated by participating in the Program;
- No time to learn about the Program.

2.5 CONCLUSIONS AND RECOMMENDATIONS

2.5.1 Preliminary Conclusions

The research findings summarized above indicate that EVT and its program contractor have done a good job of implementing the Residential New Construction program as planned. Specific observations to support this conclusion are as follows.

- A very high percentage of new home construction projects are participating in the program. The 622 homes that received some level of program support in 2001 represent between 35 and 40 percent of the total number of single and two-family units built Vermont that year.
- Recognition of the program among builders is nearly universal except in the Northeast region.
- Thirty-nine percent of homeowners interviewed for the evaluation, most of whom had completed construction of their new homes prior to the end of the first program year (2000), recognized Vermont Star Homes.
- Efficiency Vermont moved effectively to consolidate program operations with the HomeBase program operated by Vermont Gas Systems, thus reducing potential confusion among home owners and reducing the costs and complications of program participation for builders.
- The lighting component of the program was quickly established and contributed a large portion of the program's overall electric savings. Among homeowners who elected *not* to go through the Vermont Energy Star Home process, installation of an average of 4.77 compact fluorescent fixtures is a very good result. Installation of an average of 13.66 fixtures in the Vermont Star Homes is an excellent result.

2.5.2 Key Questions for Additional Research

Roughly one third of the new construction projects that came through the project went on to obtain Vermont Energy Star Home designation. This constitutes about 10 percent of the flow of

all new single and two-family home construction in the state.³ These units contribute virtually all the thermal energy savings for the program as well as a disproportionately large portion of the electric savings. This result raises the questions:

- Why did customers and builders who were clearly aware of the program choose not to seek Vermont Star designation? The relatively low incremental costs that builders attribute to program compliance, as well as the marketing benefits they perceive suggest that increased levels of participation in the Vermont Star component could be successfully sold.
- What program changes might be made to encourage a larger portion of program participants to move up to the Vermont Star level?
- Are current baseline construction practices sufficiently different from those required for Vermont Energy Star Homes qualification that higher levels of participation in the Vermont Star Home component would contribute significantly greater actual energy savings?

The on-site survey currently in the field should help address the final question. Short, focused surveys of relatively small samples of participating builders and homeowners would help address the first two questions. We recommend inclusion of such efforts early in the next phase of the evaluation.

³ Utility-sponsored residential new construction programs with designs similar to Vermont Energy Star Homes have experienced similar or slightly lower levels of participation.

3

PRELIMINARY EVALUATION REPORT: LOW-INCOME SINGLE FAMILY PROGRAM

3.1 INTRODUCTION

3.1.1 Evaluation Objectives

This report summarizes the results of XENERGY's Preliminary Market Characterization (PMC) and Process Evaluation activities for Vermont's Low Income Single Family (LISF) Program. This program is part of the core residential program portfolio administered by the statewide energy efficiency utility, Efficiency Vermont (EVT). EVT officially began operating the core programs in March, 2000.

The LISF program is operated in conjunction with Vermont's Weatherization Assistance Program (WAP), through a Memorandum of Understanding with Vermont's Office of Economic Opportunity, the agency that administers the state's Weatherization program, and through sub-contracting agreements with individual Weatherization agencies. EVT sub-contracts with WAP agencies for delivery of energy audits, technical assistance, and electric efficiency measure installation. WAP staff deliver these services in the course of providing thermal efficiency measures in the homes of low-income clients.

The Preliminary Market Characterization was completed in August 2001 as part of a three-year process evaluation of the low-income programs. The Weatherization Program as a whole is subjected to annual impact evaluation and management review under separate contracts. Upon review of the Preliminary Market Characterization for the LISF, the Department of Public Service instructed XENERGY to concentrate its efforts on characterizing a small number of key operating issues that had raised concerns among program staff and contractors. These included the degree to which program eligibility definitions and outreach procedures capture the population in need of the program and the effectiveness of coordination between EVT and established weatherization service providers. This characterization was to be used as a point of departure for discussions among program stakeholders to develop practicable approaches to the key issues.

3.1.2 Evaluation Methods and Activities

Preliminary Market Characterization

During June and July of 2001, XENERGY conducted a series of interviews with staff from organizations involved in administering and delivering the low-income programs. These included EVT single- and multi-family low income program managers; the Office of Economic Opportunity's (OEO) statewide Weatherization program director; and directors and staff from the five weatherization (WAP) agencies that provide services throughout Vermont. In addition

to posing basic questions about program operations, the interviews also assessed participant perspectives on the degree to which program eligibility definitions and program outreach procedures capture the population in need of the program, and the effectiveness of coordination between EVT and WAP service providers. The results of these interviews were presented in the Preliminary Market Characterization Report.

Issues Update

XENERGY conducted another round of interviews in April 2002 with OEO and EVT staff to update the status of key issues identified in the earlier report, and to identify any concerns that may not have been previously addressed. Stakeholders were allowed to review the *Preliminary Market Characterization* prior to the interviews. This status report reviews the issues from the first round of interviews and provides a current commentary on those issues by program administrators, including any proposed ideas for resolution.

3.2 OUTREACH AND MARKETING

The Low Income Single Family Program, operated by Efficiency Vermont since March 2000, continues to coordinate and “piggyback” its delivery with the existing Weatherization Assistance Program (WAP). Most program participants have come through the normal WAP outreach process, with some referrals from EVT and utilities. Each of the five WAP agencies uses its own methods to identify new clients. These include mailings, referrals from other agencies providing low-income services, newspaper and radio advertisements, and participation in fairs and local events. Recipients of social services and Low Income Heating Energy Assistance Program (LIHEAP) benefits are automatically qualified, and by statute, required to participate in the WAP program (although there is no “enforcement” of this requirement.) Every few years, OEO has received lists of the approximately 14,000-15,000 LIHEAP recipients, divided the lists by WAP territory, and distributed the lists to local WAP agencies for marketing and outreach efforts. These efforts have been successful in generating some new client activity.

3.2.1 Recent Initiatives to Expand Outreach

In March 2002, EVT began coordinating program outreach efforts with LIHEAP administrators by providing an insert for a LIHEAP mailing to approximately 14,000 recipients. The insert included an offer for a free compact fluorescent bulb from EVT in return for answering a brief survey that could help provide leads for program marketing. EVT is anticipating receiving approximately 3,000 responses. A similar promotion is planned for mid-summer 2002, when EVT will provide another insert for a LIHEAP mailing, with efficiency tips and information about program services available through EVT/WAP.

EVT also began conducting participant telephone surveys and site visits to assess customers’ overall experience and satisfaction with the program. In over 30 telephone surveys and 4 site

visits, participants “overwhelmingly” expressed their satisfaction with the service received from WAP staff.

3.2.2 Eligibility And Access To Program By Population In Need Of Services

Eligibility Criteria

Available Alternatives. The WAP agencies confirm eligibility for most participants in the single-family program. To be eligible for WAP services, potential clients’ incomes cannot exceed 150% of Federal Poverty Guidelines. DOE has approved new eligibility guidelines, and OEO has been considering its options for changing eligibility criteria within the DOE guidelines. Among the possible options is the use of an Area Median Income guideline to align eligibility requirements more closely with subsidized housing eligibility. Most subsidized housing agencies use a percent of median income eligibility guideline, ranging from 50% to 80% of Area Median Income. HUD uses 80 percent of Area Median.

WAP guidelines are much more stringent than those used for subsidized housing. EVT’s staff compared the two guidelines in a chart showing the overlap of various income eligibility ceilings for 1 to 8 person households using both metrics. This chart shows that one-person households (and two person households in Windsor and Washington counties) need to be at or below 30% of Area Median Income to qualify for WAP services. Two- and three- person households in most counties must be at or below 50% of Area Median to meet the equivalent WAP eligibility. A change in eligibility criteria for WAP, to 60% of Area Median, which is an option under consideration by OEO, could resolve much of the eligibility disparity for smaller (two-to-three person) households. This could open new possibilities in family housing for WAP and therefore, EVT programs tied to WAP delivery. EVT notes that it would do little to assist the elderly, which tend heavily toward one-person occupancy levels per household.

Program Operator Views on Eligibility Requirements. During the first round of interviews in 2001, respondents were asked if they thought eligibility limits should be extended, and if so, which guideline they thought should be used. WAP responses unanimously supported an extension of the eligibility requirements to serve a wider population of obvious need. The responses indicated that the current definition often excludes the “working poor” who are employed, but cannot meet their obligations and needs. Another group that is often excluded by a very small margin is retirees. WAP includes retirement income in their eligibility formula, and in many cases, a modest pension will cause these individuals to be slightly over income. When asked which guideline they thought should be used, a few Directors favored increasing eligibility to 185% or 200% of Federal Poverty Guidelines. The majority suggested that the eligibility limits should be defined as a percentage of Area Median Income, to make coordination with housing groups and REEP easier.

Update. No changes have been made to WAP eligibility criteria. WAP plans to convene a Policy Committee meeting in the near future to explore various options for changes in this area.

3.2.3 Service to Renters

The LISF provides services to renters in one-to-four family dwellings using WAP guidelines for eligibility. WAP determines eligibility for services using a basic DOE requirement of 50% eligibility as a starting point. If 50% of tenants are determined to be income-eligible, then WAP negotiates a co-investment with the owner to assist with costs of the project, using a set of guidelines to determine owner benefit and contribution.

Recent efforts. Once WAP determines eligibility, EVT serves renters in the same way as it does other single family low-income participants. Incentive measures and reimbursement levels are the same, with the exception of fuel switches. If a renter who pays the electric bill has electric heat and/or hot water, and if the project meets screening criteria, EVT will pay 75% of the costs, with WAP contributing the remaining 25%. EVT has served a few clients in cooperation with Rutland West outside of the WAP program, and in these cases, determined participant eligibility based on recognized circumstantial need.

3.2.4 Re-visiting Clients Previously Served

The U. S. Department of Energy sets rules regarding the time interval required before homes improved through the WAP program can receive program services again. The DOE date for providing additional WAP services to clients previously served was amended in February 2002. WAP can return to clients' homes that were served before 1993, and provide additional services, or new measures introduced since 1993, if they pass WAP's cost-effectiveness screening guidelines.

Recent efforts. WAP often receives applications from clients that have been served in the early years of the program. This change enables WAP agencies to re-visit these homes and identify any new opportunities that the program can provide. During periods of less activity and demand, individual agencies will often review old records to identify potential opportunities to revisit clients, and will contact them to determine their current status and interest in possibly receiving additional services. EVT and one WAP agency initiated a pilot project to identify opportunities (in homes of clients served before 1993), for updated weatherization and major electric efficiency measures. OEO indicates that this pilot is still in the evaluation stages.

3.2.5 Supplementary Repairs

The lack of funding sources for health and safety repairs in client's homes was noted by many WAP respondents as a missing link in the provision of services to potential low-income clients. WAP funds for repairs are limited, and major repairs are outside of the scope of WAP and EVT's programs. WAP cannot provide weatherization services until necessary health and safety repairs are made. WAP staff report that many potential clients, some in desperate need of services, are turned away because of this issue. A few years ago, SEVCA got a \$15,000 grant to fund repairs

in homes that needed it. An Advisory Committee reviewed expenditures for repairs to ensure that the funds were used most effectively. This was very successful, but the funds didn't go far.

3.3 PROGRAM ADMINISTRATION AND COORDINATION

3.3.1 *Administrative Efforts Required for Coordination*

Overview of administrative challenges. In the 2001 interviews, there were a number of comments regarding LISF program coordination, and a general consensus that there was room for improvement. While WAP and EVT managers acknowledged that the development and implementation process for any new initiative requires many changes and a period of “debugging” during the transition, many indicated that the addition of new processes and administration had been difficult. WAP has its own data management system, data requirements, and screening protocols for project funding through DOE, and EVT has another system, differing data requirements and a separate screening process. Some WAP respondents indicated that the EVT administrative duties and “paperwork” requirements were often redundant, adding many hours to their audit and reporting duties. For EVT, each new measure includes the development of new data collection points, and new data entry and payment procedures.

From WAP's view, each new measure or activity has required one or more amendments to the sub-contracting agreement, and a change in reporting forms, often with new forms and procedures for implementation added. New protocols, installation techniques and reporting requirements for each measure must be learned in training sessions, and incorporated into the program delivery and administration. A few WAP respondents suggested that the administrative requirements could be streamlined to avoid unnecessary duplication of information. Some suggested that the program include funding for an additional staff person to fulfill the added requirements of the program. These include customer surveys of consumption; disaggregation of client electric consumption using the DISTool spreadsheet program developed by EVT; project screening; packaging and placing orders for lighting fixtures, bulbs and refrigerators, and follow-up with suppliers. With the funds from EVT program labor rate reimbursements, two agencies have been able to hire additional staff specifically for these duties. They have found that this solution worked well to reduce the burden on existing staff.

During the first interviews, a few respondents suggested that regularly scheduled meetings among EVT, OEO and WAP agencies could enhance communications and coordination among these agencies. Other suggestions included streamlining and consolidating forms, reports and procedures to reduce duplication of inputs and overall “paper work” requirements.

Efforts to address administrative issues. During the past year, EVT has worked with the WAP agencies to combine a number of forms to help reduce the administrative burden on the WAP agencies. For each measure reimbursed by EVT, the number of fees and forms have been reduced and consolidated. Initially, there were multiple fee schedules and forms for various services. Many of these have now been combined and simplified. Hardwired lighting fixtures

formerly included 5-6 different forms for analysis, construction management, with three different tracks of separate fees. These have now been consolidated into two forms.

Since November 2001, EVT has scheduled quarterly meetings between EVT, OEO and WAP agencies. EVT is planning to continue to host quarterly meetings for the entire group to gather and discuss issues, program plans and changes.

While recent contract negotiations between EVT and WAP/OEO regarding performance incentives and audit fees were difficult, all parties have agreed to continue the relationship and efforts to improve it.

3.3.2 Administrative Initiatives to Address Narrowly-defined Issues

A few specific administrative issues were raised by respondents during the first interview process. A brief overview and update of each issue follows:

- ***Disaggregation of client bills using the DISTool developed by EVT.*** The DISTool is used by WAP auditors for high-use clients or potential fuel switch candidates, to determine electrical consumption for various end uses. During the first interview process, several WAP respondents commented about difficulties using the DISTool. The comments were focused on the amount of time required to prepare a client disaggregation, the tool's user un-friendliness, the many modifications to the tool; and the sometimes unrealistic results that the tool provided.

DISTool Update. The tool has been continually evolving, and some of the inputs have been modified. EVT reports that the WAP agencies are becoming more familiar with the use of the tool and seem to be more comfortable with it. Both EVT and the DPS are reviewing the DISTool to identify modifications that could provide more accurate results. There are two WAP agency staff technical DISTool reviewers who have been re-examining each DISTool analysis completed by WAP staff for accuracy. EVT is now arranging for the technical reviewers to have access to actual customer usage information to compare to DISTool results.

- ***Speedbill process.*** EVT has access to the client's electric utility consumption data, and sends this info electronically to WAP agencies via an email attachment. At the time of the first interview process, WAP staff had positive comments about the overall speedbill process, citing its efficiency and quick access to customer consumption data.

Speedbill Update. In January 2002, EVT implemented a process to ensure that the most recent customer consumption data at EVT is available to WAP staff. This was done as a result of some earlier problems with WAP accessing the most current consumption data.

- ***Procurement of materials by WAP agencies.*** Initially, EVT had hoped to standardize the types of materials and equipment used and related cost reimbursements, but WAP agencies have not supported this change with regard to their purchase of light bulbs and weatherization materials. Lighting fixtures have been standardized, with WAP agencies ordering from the same distributor, and costs charged directly to EVT. Initially, there were availability problems with some fixtures. EVT cites the need to manually input the differing types and prices of equipment into their data management and payment systems among the reasons to change to a standardized system.

Procurement Update. Each WAP agency has its own preferred established vendors for light bulbs and weatherization materials, and agencies continue to use their preferred vendors. The earlier problems with fixture availability have been resolved. EVT is working with WAP agencies to encourage a reduction in stored inventory at agency storage facilities.

- ***Differing Program Requirements, Measurements of Success.*** The OEO contracts with WAP agencies are based on numbers of units served. However, agencies' success is also measured by other factors including the average cost per job, and/or material to labor rates. The Weatherization impact evaluation process, completed every two years, has traditionally measured the overall success of the statewide WAP program, with a focus on BTU savings. Under contracts with EVT, WAP success is measured in terms of mWh savings resulting from program activities. These differences have resulted in some disconnection between the two programs, although this does not seem to impact program administration.

Differing Requirements Update. No change in status of these issues.

- ***Opportunity for New Measures.*** During the interview process, participants were asked if they had any suggestions for additional measures that would be beneficial to their clients and could complement existing program activities. The following recommendations were made by WAP staff:
 - Energy efficient freezers – Many low-income homes have inefficient freezers, especially in rural areas that are not in close proximity to supermarkets.
 - Cook stove switch from electric to gas, possibly packaged with a domestic hot water fuel switch project (if propane is brought in for the new system). Or, a new gas stove if existing gas stove is producing high Carbon Monoxide levels.
 - Replace inefficient appliances, especially microwave ovens. According to WAP staff, almost every home has a microwave now.
 - Water pumps – if metered results show spikes in bills.

Opportunities Update. Energy efficient freezers have recently been added to the refrigerator component. EVT is also considering the benefits of replacing waterbed mattresses with standard mattresses.

3.4 CONCLUSIONS AND RECOMMENDATIONS

The Low-Income Single Family program represents a fairly bold attempt to combine the capabilities of two very different kinds of organizations to accomplish one objective, namely: the reduction of electric use by low-income households. The Office of Economic Opportunity (OEO) and the local WAP providers constitute a system of organizations that has evolved over a long period of time to meet the needs of low-income residents on one hand and the administrative requirements of their major funder – the U. S. Department of Energy -- on the other. Moreover, the WAP providers are part of larger local agencies with the broader mission of providing a wide range of support services to low-income residents. Over time, these organizations have invested a great deal in systems designed to meet the needs of their clients and the requirements of DOE. Many of the key individuals in this system have been with the program for decades, and believe that they are in the best position to understand the energy efficiency programs for low-income residents and the market for those programs.

While many EVT staff and managers involved with the LISF have extensive background in programs for low-income customers, EVT's essential mission is to develop and deliver programs to capture cost-effective electric savings. Moreover, EVT must document its accomplishments in sufficient detail to justify program expenditures and reimbursement of those expenditures. This naturally leads to a strong emphasis on measure screening, standardization of materials and procedures, and recordkeeping.

WAP and OEO officials report that it has been difficult to reconcile their interests with those of EVT in the administration of the program. Several WAP respondents indicated their frustration with the overall change in program administration. While acknowledging the added value to clients that the program provides (in terms of funding for a range of electric measures), they felt that the predecessor piggy-back programs with the utilities had worked better and developed an solid track record. They believed that the new program structure reduced their role to that of a contractor to EVT and was not the partnership in addressing their market that they had anticipated. WAP staff and directors are proud of their work and confident of their abilities, and in this new framework. Many felt that they were not given the respect and consideration that they would expect to receive as partners, particularly in the most recent round of negotiations on fees and performance incentives.

Against this backdrop, the range of improvements to program marketing and administration discussed above is both encouraging and impressive. However, it appears that further progress in this regard will require the development of an organizational structure or contracting procedures that are more acceptable to both EVT and the WAP establishment. Given the that at

least one party views the conflicts as deep-seated and emotionally charged, progress in resolving those contracts might best be made with the assistance of a professional negotiation specialist.

INTERIM SUMMARY REPORT

ASSESSMENT OF THE COMMERCIAL & INDUSTRIAL SECTOR MARKETS AND ACTIVITIES OF VERMONT'S ENERGY EFFICIENCY UTILITY

MAY 24, 2002 – DRAFT



**PREPARED BY THE
GDS ASSOCIATES TEAM**

INCLUDING:

**GDS ASSOCIATES, INC. – RESEARCH INTO ACTION
MEGDAL & ASSOCIATES – B&B RESOURCES
AND
ACTION RESEARCH**

TABLE OF CONTENTS

<u>Introduction</u>	<u>1</u>
<u>Background and Enabling Legislation</u>	1
<u>Evaluation Approach</u>	2
<u>Sampling</u>	3
<u>Analysis</u>	5
<u>Description of Efficiency Vermont Commercial Industrial Programs</u>	6
<u>Marketing</u>	7
<u>Program Implementation</u>	7
<u>Summary of EVT Commercial and Industrial Programs Activities</u>	8
<u>Summary of Market Actor Results</u>	<u>10</u>
<u>Market Characterization</u>	10
<u>Characterization of Designer and Contractor Markets</u>	10
<u>Characterization of Supplier Markets</u>	12
<u>Market Structure</u>	15
<u>Client Concerns for Energy Efficiency</u>	15
<u>Promotion of Energy Efficiency</u>	15
<u>Energy Efficiency Decision-Making</u>	16
<u>Barriers to Implementing Energy Efficiency</u>	17
<u>Current Energy Efficiency Practices</u>	21
<u>Architects and Design Engineers</u>	21
<u>General Contractors</u>	23
<u>Electrical Contractors and Lighting Suppliers</u>	24
<u>Mechanical Contractors and HVAC Suppliers</u>	26
<u>Window Suppliers</u>	27
<u>Motor Suppliers</u>	28
<u>Baseline Measurements for Market Indicators</u>	29
<u>Architects and Engineers</u>	29
<u>General Contractors</u>	30
<u>Electrical Contractors and Lighting Suppliers</u>	30
<u>Mechanical Contractors and HVAC Suppliers</u>	31
<u>Window Suppliers</u>	32
<u>Motor and VFD Suppliers</u>	32
<u>Program Process Findings</u>	33
<u>Act 250</u>	33
<u>Efficiency Vermont</u>	33
<u>Recommendations</u>	35
<u>Population and Sampling Framework</u>	<u>37</u>
<u>Vermont's Population Characteristics</u>	37
<u>Nonresidential New Construction</u>	39
<u>Nonresidential New Construction Permits</u>	40
<u>Nonresidential Renovation, Remodeling, and Additions</u>	45
<u>Appendix A – Researchable Questions</u>	<u>1</u>
<u>Appendix B – Survey Instruments</u>	<u>1</u>
<u>Appendix C – Sampling Plans</u>	<u>1</u>

Introduction

Background and Enabling Legislation

On June 1, 1999 Vermont Governor Howard Dean signed into law Senate bill 137. The law placed the Vermont Public Service Board, rather than the state's utilities, into the lead role for the development and implementation of gas and electric energy efficiency and conservation programs. It further established the capability for the Board to institute an energy efficiency charge, based on electric usage, to fund these efforts; also placing a limit on the charge that the proceeds shall not exceed a total of \$17.5 million dollars per fiscal year.¹ The Board was mandated to ensure that all retail consumers have an opportunity to benefit from cost-effective energy efficiency programs and initiatives designed to overcome barriers to participation. Furthermore, the law required the Board to promote coordinated program delivery.

The legislation was the direct result of negotiation among Vermont's electric utilities and the Department of Public Service (DPS). In the course of a few short months in 1999, a Memorandum of Understanding (MOU) agreeing to the creation of an Energy Efficiency Utility (EEU) was signed by all parties to Docket No. 5980.² Senate bill 137 reflected this agreement.³

As a result of the legislation, the Board issued a request for proposals for entities to provide efficiency services as an EEU for the state of Vermont. The project was awarded to Vermont Energy Investment Corporation, headquartered in Burlington, VT. The first EEU in the nation, Efficiency Vermont (EVT) began operation in March 2000, with a three-year contract and budget of \$27,035,970. The projected annualized MWh savings for the first three years are 84,603.⁴ EVT offers seven programs to citizens of Vermont, two of which exclusively target commercial and industrial customers. By December 31, 2001, EVT documented savings of 60,359 MWh, of which 50% are in the commercial and industrial electric utility customer sector—the focus of this report.

¹ The charge is only on electric usage. Gas efficiency measures continue to be provided by the gas utility.

² Vermont Department of Public Service Biennial Report, July 1, 1998 – June 30, 2000. January 2001.

³ Docket No. 5980 was opened by the Board in the spring of 1997, after the Department filed its proposal for statewide delivery of seven core DSM Programs. That proposal was entitled: *The Power to Save: A Plan to Transform Vermont's Energy Efficiency Markets*.

⁴ The efficiency utility serves the service territories of Vermont's electric utilities. In addition, EVT has agreements with some municipal utilities to deliver core program services. In the case of Burlington Electric Department, the agreement is to coordinate deliver the core statewide programs. Some municipal and public utilities continue to offer programs in addition to the statewide programs.

Evaluation Approach

With the passage and signing of Senate Bill 137, the role of the Public Service Department shifted from overseeing multiple DSM-related utility programs to overseeing EEU services and conducting an evaluation of the EEU. While the Department retains its responsibility under Vermont law to assure that investments in energy efficiency are cost-effective and comprehensive, with EVT there now is a single statewide entity to oversee, rather than the 22 electric utilities of previous years. The DPS is responsible for conducting a formal evaluation of energy efficiency program performance and markets, activities that were previously carried out by the utilities and overseen by the DPS.

In October 2000, the DPS issued a request for proposals to conduct an evaluation of EVT. The team of GDS Associates, Research Into Action, Inc, Megdal & Associates, B&B Resources, Action Research and SAIC (the GDS team) were selected to conduct an evaluation of the commercial and industrial market programs of EVT. The GDS team met with the DPS and EVT staff to initiate the project in February 2001.

In preparing a description of evaluation activities to be conducted, the DPS identified as a key problem the need to balance the competing issues of the evaluation.

“The Department will seek to balance its concern for defining markets broadly (thus attempting to take account of many market factors), with the reality of its limited evaluation budget. Achieving this balance will require the DPS to prioritize market characterization activities and, in some cases, limit the scope of such activities. The DPS will seek input from EVT and the Contract Administrator in establishing the priorities and scope of these activities.”⁵

The struggle to balance these interests has proved to be among the most complex aspects of the evaluation.

The first evaluation activities focused on the development of a work plan. The work plan had two primary goals: (1) to ensure that information on market characterization and structure would be collected for use by EVT and the DPS in program planning; and (2) to ensure that data were collected for assessing market progress. The specific objectives to meet these goals are:

Objective 1 - Improve understanding of the markets in Vermont and of current levels of awareness and utilization of energy efficient products and services;

⁵ Memo from Scudder Parker to Vermont Public Service Board Evaluation RE: Effort: Report, and Plans for Energy Efficiency Utility Evaluation Projects. December 29, 2000

Objective 2 - Assess EVT's ongoing implementation activities within the context of these markets;

Objective 3 - Assure that best approaches are being utilized by EVT to maximize savings and overcome barriers;

Objective 4 - Identify existing program modifications to improve effectiveness within key markets; and

Objective 5 - Help develop the "story", the chain of linkages between barriers, interventions, outcomes, and outputs for the January 2003 report that documents progress and identifies opportunities for continued improvements in the interventions for maximum movement towards the EEU goals.

The GDS team's initial research focus was designed to provide a broad basic understanding of the commercial and industrial (C&I) markets in Vermont. This market understanding includes specific measurements from key market actors that can be used as baselines to track market progress within new construction, remodeling, and retrofit activities. At the same time, the broad scope and limited number of market actors in Vermont led the evaluation team to believe that this look at the market could also provide a backdrop for future EVT program development and refinements across several program areas. As such the evaluation is truly more of a qualitative look at the Vermont markets than a quantitative measurement tool.

With this perspective, a set of researchable questions was developed following interviews with EVT staff, BED and other electric utility staff, and some key market actors in Vermont. An initial set of researchable questions were sought from EVT directly, to ensure that questions EVT had regarding the direction, content and quality of their programs were covered. The list provided by EVT was extensive, reinforcing the need for conducting an initial market characterization. Using the EVT list, the results of the initial interviews and the evaluation objectives, the GDS team developed a final set of researchable questions. These researchable questions, provided in Appendix A, formed the framework for the data collection instruments for the baseline market conditions, structure and indicators work conducted and reported on here. Copies of the final Market Actor and End-User telephone survey instruments are included as Appendix B to this report.⁶

Sampling

The GDS team developed draft and final sampling plans for Market Actors, End-Users and End-User On-Site visits, which the DPS and EVT approved. These detailed sampling plans are

⁶ Development of these survey instruments was a collaborative effort, starting with a draft instrument prepared by the GDS team, an extensive comment period where DPS and EVT parties provided feedback and suggestions, and a revised and ultimately final version of each instrument.

presented in Appendix B. Beginning November 2001 and continuing into late spring 2002, the market actor and end-user sampling plans formed the basis for interviews that have been conducted with a variety of market actors across Vermont. In total, nearly 150 Market Actor interviews were completed, and efforts are well underway to conduct telephone surveys with over 400 End-Users. Site-Visits for up to 80 of the end-use customers will then be completed (currently scheduled to occur during the summer 2002).

The sample design for these interviews is shown in Table 1. We note that the sample sizes for all categories except end-users are too small to draw statistical inference. There are two interrelated reasons the sample sizes are so small. The first is that the populations for Vermont market actors, shown in the population estimate column, are so small that the population was often nearly exhausted in obtaining even the small samples we targeted. As is shown in the table, for seven of the nine market actor groups, the GDS team contacted between two-thirds and 90% of the population to achieve the completed interviews. The second reason, related to the first, is that achieving statistically valid sample sizes would have required three to four times the resources that were available for this project. Thus, the DPS and EVT agreed that information at a more qualitative level provided sufficient value.

Table 1. Sampling Plan 2001-2002 Baseline Data Collection Activities

Commercial/Industrial Sector Market Participant Groups	Estimated Population ^a	Sample Planned	Completed Interviews	% of Population contacted	Approach
Market Actors Supplying Services					
*Architects (individual)	126	30	30	67%	Phone
*Mechanical & electrical Engineers	67	15	15	88%	Phone
*Electrical Contractors	152	25	23	56%	Phone
*HVAC Mechanical Contractors	149	25	19	64%	Phone
*General Contractors	205	30	31	70%	Phone
*Motor suppliers	41	5	5	89%	Phone
*Lighting/Electrical suppliers	39	10	7	85%	Phone
*HVAC/Mechanical suppliers	48	5	4	42%	Phone
*Windows suppliers	154	5	5	66%	Phone
Market Actors Purchasing Services Supplying Buildings					
*Commercial developers	TBD	5	TBD	TBD	Phone
*Real Estate agents and brokers	TBD	10	TBD	TBD	Phone
End-users Purchasing Services					
*New Construction	TBD	200	TBD	TBD	Phone
Act 250	TBD	30	TBD	TBD	On site
Non-Act 250	TBD	10	TBD	TBD	On site
*Existing Construction	TBD	230	TBD	TBD	Phone
Commercial	TBD	10	TBD	TBD	On site
Industrial	TBD	5	TBD	TBD	On site

a. The estimated population was developed following completion of the data collection based on the disposition results for each survey.

Analysis

The qualitative nature of the data, due to the small sample sizes, has important ramifications for this analysis. First, in no case other than end-users is it possible to apply statistical analysis methods beyond that of counts and frequencies.⁷ The results do not describe the market actors with any known degree of accuracy, such as would result from a statistically representative sample. Rather the results are indicators of how each market actor group is behaving and how the building and construction market as a whole is behaving relative to energy efficiency.

At an aggregate level, each market actor group can be compared. However, within each market actor group, comparisons between large and small firms, between firms that do remodeling or new construction, and so on must be considered suggestive and not definitive.

In this Interim Summary Report, counts and percentages have been provided for all responses and cross tabulations of answers. The percentages are only for the purpose of enabling the reader to more readily interpret the counts of responses obtained across the different subgroups. Means (averages) or other measures of central tendency have not been used because these imply a level of precision that is not possible given the research and sample limitations placed on this evaluation effort. In addition, our data was usually ordinal or nominal, not continuous—the only condition for which it is appropriate to use such measures of central tendency.⁸

Interviews were conducted with architects, electrical and mechanical engineers, mechanical, electrical and general contractors and mechanical, lighting, motors and windows suppliers for commercial and industrial buildings in Vermont. When designing survey instruments and conducting interviews, the GDS team included the same set of questions, as closely as possible, across a range of market actors and market participants. The 149 market actors and **TBD** end-users we spoke with represent a substantial number of participants in the building and construction market for Vermont. By comparing and contrasting their responses to the questions we are able to draw conclusions about how the commercial/industrial building market is functioning, its structure and characteristics, the awareness of energy efficiency and the prevalence of energy efficiency behaviors. These conclusions are presented in the summary section of this report, immediately following a description of EVT's commercial and industrial programs below. More detailed information regarding the Vermont C&I population and sampling framework, and results from the GDS team's interviews within each market actor group are presented as separate chapters following the Summary section of this report (**NOTE: drafts of these separate market actor group chapters have already been shared with the DPS and EVT parties and revised/final versions are currently being prepared for ultimate inclusion in**

⁷ Even for end-users statistical validity is only possible at the aggregate level, not the sub-group level.

⁸ By ordinal we mean scales such as 1 to 5, or 1 to 10. By nominal we mean categories such as yes, no, or options a, b, c. By continuous we refer to interval or ratio data such as commonly found in income, age, revenue, or other such data with integers and fractions that are consistent throughout the scale.

this Interim Summary document. Later in the summer, when the end-user telephone surveys and the on-site visits have been completed and results from those efforts have been analyzed, this Interim Summary Report will be reviewed and revised to reflect additional findings).

Description of Efficiency Vermont Commercial Industrial Programs

As part of this evaluation, it was important that the GDS team familiarize itself with EVT's current menu of commercial and industrial program offerings, overarching policy documents, and other relevant reports and studies. Therefore, before designing and fielding its market actor and end-user surveys, a number of interviews were conducted with EVT staff, BED and other electric utility staff, and a select group of market actors. Key EVT program materials were also reviewed along with a number of Vermont-specific policy documents and reports and studies of similar programs that have been conducted throughout the northeast region. Appendix D provides a list and brief summary of all documents reviewed. Results from these interview and document review efforts yielded the following brief overview of EVT's current C&I program offerings:

Overview

EVT offers two programs for commercial and industrial businesses: the Commercial Energy Opportunities (CEO) program and the Commercial Industrial Emerging Marketing (CIEM) program. These programs, as currently structured, are resource acquisition programs. As an underlying strategy, they intend to create a strong market trade-ally network and support system.

CEO activities consume the majority of EVT C&I staff effort. The CEO program focuses on new construction and renovations and on replacement and remodeling opportunities. Technical assistance, customized incentives and prescriptive incentives for building lighting, LED exit lights, motors, unitary HVAC equipment and dual enthalpy economizers provide the tools for working with these projects.

The CIEM portion of the program was fully initiated during 2001. While still being further defined, the CIEM deals with large comprehensive retrofit opportunities and specialized services for schools and water and wastewater facilities. In addition, CIEM is the location of efforts for day lighting, variable frequency drives and coordination with other New England states on electric lighting system design.

EVT is also working to develop a strong market trade-ally network, providing outreach to the trade-ally community, with the goal that trade allies will come to EVT with projects. In addition, EVT hosts an annual Building Solutions Conference each February. The conference introduces efficiency solutions to design, development and building professionals.

Marketing

EVT's C&I program(s) marketing process has six main avenues:

- EVT staff monitor the Works In Progress (WIP) publication on a weekly basis to identify construction projects that are just getting underway.
- The DPS typically directs project sponsors in the Act 250 process to go to EVT for assistance in responding to the Act 250 energy guidelines⁹.
- EVT Business Development staff follow-up on WIP and other leads to identify projects just getting underway or that may be further in the process but were missed at the outset.
- Leads come from utilities throughout the state that have direct contact with customers.
- Trade-allies notify EVT of projects and work with EVT to complete the project. EVT Business Development staff attend meetings of trade-allies to inform them of what EVT is doing.
- EVT uses collateral such as bill stuffers as advertising to inform Vermont building decision makers about the EVT opportunities.

According to EVT staff, the use of collateral has been the least effective marketing approach; the other methods are usually linked to projects. EVT and the utilities expressed little concern about identifying non-ACT 250 projects. Both groups were confident that utilities and the EVT business development staff generally are able to identify these projects.

A key effort on the part of the Business Development staff in 2001 was to meet with the "Top 100" firms, a list which actually comprises closer to 200 firms in the state. The list contains the largest customers of every utility in the state. Thus, the largest customer for a small municipal utility could be relatively small compared to the largest firms in Chittenden County, yet even so it would be included as a key customer for EVT. Business development staff met with these firms to identify project opportunities and explain EVT services.

Program Implementation

EVT has developed screening tools for determining incentive options for projects. They use both prescriptive and custom incentive structures. Customers choosing the "Express" version of a program are offered prescriptive incentives, which require applicants to complete a single page form. These incentives apply to lighting, motors and packaged cooling and heating units. The motors and HVAC equipment incentives and forms are consistent with those used in the "Motor Up" and "Cool Choice" programs sponsored throughout New England by the Northeast Energy Efficiency Partnership (NEEP).

⁹ Note: 1998 Consolidated Guidelines (VT Consolidated Act 250 Energy Guidelines for Typical Commercial and Industrial Buildings) were introduced in October 1998 – these Guidelines were updated in October of 2001 with the 2001 Vermont Guidelines for Energy Efficient Commercial Construction to incorporate much of the 1999 ASHRAE amendments.

Some measures that currently receive custom incentives may become more prescriptive in the near future. These are measures that are proving to be quite common and to have fairly standard savings, such as refrigeration door heaters, anti-sweat measures and economizers. EVT is working on a method to permit these measures to become more prescriptive. In general, custom measures involve more effort to calculate the savings and interaction effect; screening tools and modeling are required. Incentives are also negotiated, with a maximum of 80% of incremental cost possible. To date, most incentives have been in the range of 20-50% of incremental cost.

In 2001, EVT worked on two broadly defined implementation issues. The first was how to position the role of EVT in the thinking of building decision-makers during the ACT 250 process. The second was the development of the CIEM program.

There are a variety of issues concerning ACT 250 and the energy guideline statement that the building should include the "best available technology." Among these issues is the response of customers to EVT. Customers sometimes view EVT's role in the ACT 250 process as "regulatory" rather than advisory, particularly if advice from EVT becomes permanently attached to the ACT 250 permit. EVT staff also expressed concern about the degree of consistency in application of these guidelines. They also wondered what will be the effect of DPS's promotion of the IECC 2000.1 and ASHRAE 90.199 energy codes as part of compliance with Act 250.¹⁰ (Note we understand that the issues with Act 250 have been addressed in 2001, but have not followed-up with EVT on the effect of these changes.)

The second set of implementation issues was the CIEM program. The CIEM effort was fully launched by the end of 2001. Business Development staff identifies these projects or utilities recommend to customers with high bill complaints that they explore efficiency solutions. These activities now have a designated program manager and the CIEM effort is moving forward.

Summary of EVT Commercial and Industrial Programs Activities

EVT offers efficiency solutions and incentives to parts of the state that have not had any services in the past. EVT staff conclude that there are high levels of receptivity and interest throughout the state.

By the end of 2001, EVT programs were available throughout the state of Vermont. EVT reported expanded participation throughout the state both by county and utility service

¹⁰ The State of Vermont adopted the 2001 Guidelines for Energy Efficient Commercial Construction October 15, 2001. The Guidelines will be used for Act 250, have been adopted by the City of Burlington as their energy code, and are likely to be adopted by all public agencies in Vermont.

territory.¹¹ This participation occurred in the midst of an economic downturn that began in the fall of 2001 and resulted in layoffs and hiring freezes in facilities throughout the state.

Understandably, EVT staff members view the first year 2000 as a ramp-up year; 2001 saw an expansion and consolidation of efforts. Staff developed screening tools in 2000 and 2001. These tools are considered to be effective. New forms were developed in 2000 and EVT worked with contractors to make the switch to the new forms.

The Business Development team was active in 2001. Commercial projects can take a long time to evolve from concept to construction. Some of the projects that utilities had identified in 1999 were completed in 2001. Some of the projects that the Business Development team are actively discussing will not enter the construction phase for several more years.

For the first time, the 2001 Building Solutions conference addressed commercial issues. Previously (1999 and 2000), only residential construction were covered. The 2001 conference had over 100 attendees, and the 2002 conference attracted about XXX people.

¹¹ Efficiency Vermont Annual Report 2001, submitted March 1, 2002 to the Vermont Department of Public Service and the Efficiency Vermont Contract Administrator.

Summary of Market Actor Results

As noted above, the GDS team conducted interviews with architects, electrical and mechanical engineers, mechanical, electrical and general contractors and mechanical, lighting, motors and windows suppliers for commercial and industrial buildings in Vermont. For each of these market actor groups we sought to interview a cross section of businesses for which at least 10% of their sales go to Vermont projects. As discussed previously, the sample is highly qualitative and thus provides indicators of behavior rather than statistically robust measures of behavior.

This section looks within and across the market actor groups interviewed and attempts to summarize the information that has been obtained to date. Key findings are presented in each of the following 5 areas-of-interest categories: (1) market characteristics; (2) market structure (including identification of barriers to implementing energy efficiency); (3) current energy efficiency practices; (4) baseline measurements for market indicators; and (5) program process findings. A brief definition of the category is included at the beginning under each findings heading. The section concludes with recommendations to the DPS as to how to proceed in reaching the market actors and in measuring program effects for these market actors.

Market Characterization

The issues of market characterization concern the size of businesses offering services for commercial and industrial buildings in Vermont, the volume of sales, the type of construction in this sector, and the types of clients these businesses have.

Characterization of Designer and Contractor Markets

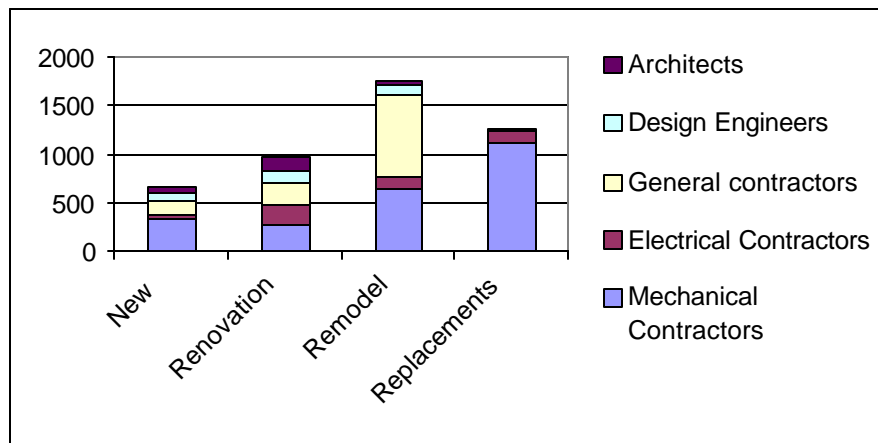
Many small firms doing mainly relatively small projects dominate Vermont's nonresidential construction market. Only 13% of the permits for nonresidential new construction in 1998 and 1999 were for projects over 25,000 square feet, while nearly 50% of the permits were for projects less than 5,000 square feet (see Chapter on population and sampling framework). Across all of the market actors, most of the firms we spoke with were small. We typically were able to talk to owners, presidents and principals in the firms.

The GDS team intentionally sought to contact a higher proportion of the larger firms in each category and was successful in most instances. Since the largest projects are done by the larger firms, we believe we learned about market conditions across projects comprising a larger total square footage than we would have had we just accepted a random sample. Suppliers proved to be the most difficult group to characterize, both because we began with a smaller sample goal and because suppliers proved to have wide variation in the equipment they sold and the markets they served and were more likely to refuse to talk with us.

Unlike some regions of the country, where there are specialty firms for nonresidential buildings, Vermont market actors who work on commercial and industrial buildings or who supply equipment to these buildings also tend to provide services to the residential sector. We found very few firms that were solely working in the commercial and industrial sector; most of those that we did find were general contracting firms.

Figure 1 displays, by market actor, the total number of projects completed by the design and contracting firms we talked with in the past year. These should be viewed in light of the total number of permits for new construction and remodeling, renovation and additions for 1998 and 1999 reported in the Department of Labor and Industry and Act 250 databases. The permit numbers were 471 new construction permits and 368 remodel, renovation, addition permits in 1998 and 1999.

Figure 1 – Number of Projects Completed in the Past Year



The total number of projects for architects, design engineers and electrical contractors are close to what one might expect based on the permit data reviewed. However, the numbers of projects reported by mechanical and general contractors are much higher than the number of permitted projects. We suspect two possible explanations. The most likely is that large volumes of small-scale remodeling and renovation construction projects are occurring without any type of permit, since requirements for permits are based on size of project rather than the fact that a project is occurring at all. A second possible explanation is that our contacts were not accurate in their estimation of the number of projects. While that seems quite plausible, it is notable that the mechanical contractor with the largest volume of business provided the most detailed numbers.

We found that the designer and contractor groups we surveyed conducted different proportions of new construction, remodeling, and renovation work as well as different proportions of design-build work. For example, nearly three-quarters of the general contractors reported doing

at least some design-build while only ten percent of the architects reported doing any design-build. Contractors tend to report more new construction projects in a year than do architects.

We defined renovation as a “major remodel or gut rehab” and found that architects, engineers, general contractors, and electrical contractors report conducting more renovation projects in the past year, while mechanical contractors report more new construction and remodeling projects. Although over half of the mechanical and electrical contractors reported doing straight equipment replacement projects, most do very few. An exception was one large mechanical contractor that reported around 900 replacement projects in the past year.

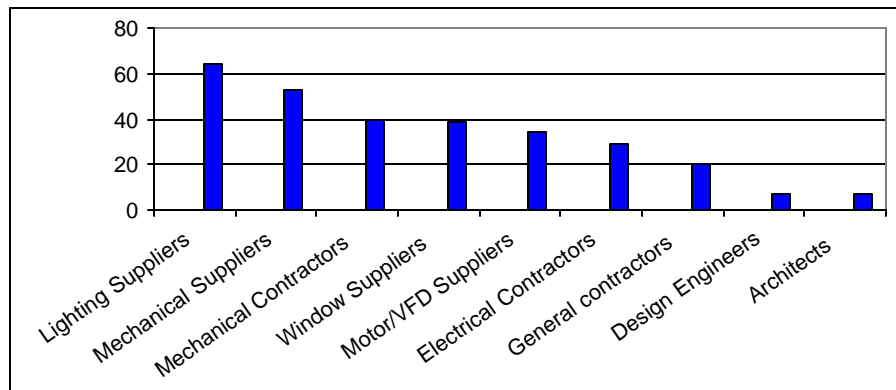
Designers and contractors all report that the majority of their projects are for owner occupied facilities in the private sector. A very small percentage of the work done by contractors or designers is for owners who plan to sell the building. Several contractors in each category and several designers reported that they have done work for owners who plan to lease their building. These findings are consistent with the permit data reported in the Chapter on population and sampling framework.

We conclude that the Vermont nonresidential construction market is characterized by the involvement of contractors—general contractors, electrical and mechanical—in the vast majority of projects. Frequently they take the role of design-builder. Architects and engineers are less frequently involved in projects, tending to work primarily on larger projects. Architects and engineers typically report involvement in about four or five projects a year. Seventy-five percent of the architects and all of the engineers report completing in excess of 20,000 square feet worth of projects in the past year. Both types of designers appear to be working on projects that are over 5,000 square feet, and most of the projects are for owner-occupied facilities in the private sector.

Characterization of Supplier Markets

The picture we are able to draw of the suppliers market is less clear than that which we can formulate for designers and contractors. This lack of clarity results from two factors: (1) our samples were quite small; and (2) we experienced high refusal rates among the suppliers, which can result in a biased sample.

Figure 2 displays the refusal rates for each of the market actor groups. Electrical suppliers and mechanical suppliers had very high refusal rates.

Figure 2 – Market Actor Refusal Rate

Fortunately, the supplier interview process revealed fairly clear information about the population size. We can identify less than 50 firms supplying each of the types of equipment for commercial and industrial construction in Vermont. A few of these firms are located outside of Vermont, usually in New Hampshire or New York.

The supplier market place is similar to that of contractors: primarily small firms sell equipment for commercial and industrial projects in Vermont, along with a few moderately large firms. The supply firms are scattered throughout the state, with many small firms located in the rural areas. With just a few exceptions, the supply firms we spoke with sell equipment to all sectors, not just the nonresidential sectors. This finding was true for motor suppliers as well as for suppliers of other types of equipment.

The firms we spoke with represented two different levels of suppliers, some were wholesalers and distributors and others were retailers and installers who also distribute. We found one mechanical and one motor supplier that had exclusive relationships with single manufacturers, but most suppliers sold products from various manufacturers.

We found some confusion among suppliers regarding terminology. For example, one mechanical supplier did not recognize the term “packaged HVAC units” when asked about the categories of equipment sold, but in a subsequent discussion of specific equipment reported that the firm sold packaged and split systems. Of the seven window suppliers interviewed, only two recognized the term “glazing” as meaning windows. This particular confusion lead to a significant loss of data for the project.¹²

¹² We note that we asked EVT staff to review the wording for products and equipment in every survey. We asked that all terms be checked to ensure consistency with common usage in Vermont. Our findings suggest that additional work is needed to identify the optimum terminology for energy efficient equipment in Vermont.

Although we do not have sufficient information from our sample to support sales tracking, we believe the data provides an adequate cross section of the supplier markets. Should the DPS decide that sales tracking is important, an approach can be developed from this initial effort that would achieve satisfactory results.

Market Structure

The issues of market structure include client concerns for energy efficiency, how equipment and efficiency are promoted, decision-making practices, and barriers to implementing energy efficiency.

Client Concerns for Energy Efficiency

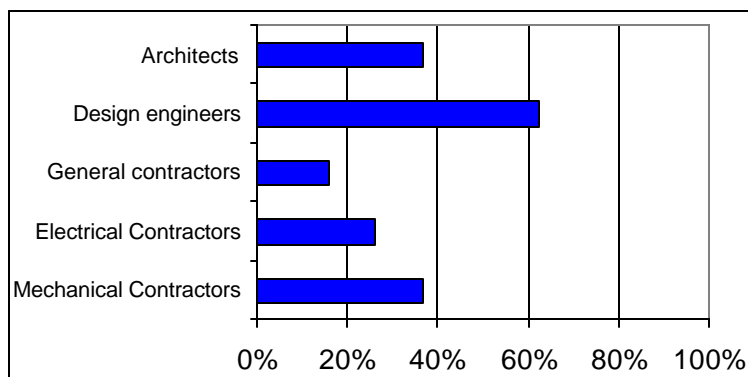
We asked architects and engineers detailed questions about their clients' commitment to energy efficiency. From this line of inquiry, we conclude that client commitment to energy efficiency is limited. Both architects and engineers report that their clients asked about energy efficiency or expressed a commitment to energy efficiency at project outset about 60 to 75 percent of the time. Yet, actual project designs were likely to include energy efficiency solutions for less than 25 to 30 percent of the projects these designers had worked on.

One third to a little over half of the contractors, designers and suppliers report that their clients are more concerned about energy efficiency in this past year than in previous years. However, similar proportions of respondents reported that their clients had the same level of concern as in previous years. Architects were more likely to report that their clients were now more concerned about energy efficiency, while contractors and engineers were more likely to respond that their clients had the same concern. About ten to 15 percent of contractors and engineers indicated their clients were less concerned with energy efficiency this past year as compared to previous years.

Promotion of Energy Efficiency

Figure 3 shows the degree to which various respondent groups market their energy efficiency capabilities.

Figure 3 – Market Energy Efficiency Capabilities



The majority of respondents in all sectors say that they discuss energy efficiency with their clients. However, we found that engineers are more likely than architects to market their capability with energy efficiency. Among contractors, mechanical contractors are more likely to market their capability with energy efficiency than are electrical or general contractors.

Suppliers also claimed to discuss energy efficiency with their customers and to promote energy efficient products, yet their comments suggest that their practices vary. Window suppliers and lighting suppliers appear to be the strongest advocates of efficient products. All seven window suppliers and five of the seven lighting suppliers interviewed indicated that they advocate energy efficient equipment 100 percent of the time. The remaining two lighting suppliers indicated that their recommendations varied by project according to the specific project requirements.

Mechanical suppliers reported a lower level of efficiency marketing practices. Only one supplier said that they promote energy efficiency nearly all the time. The other three mechanical suppliers interviewed said that they promote efficiency 50 to 80 percent of the time, depending on the project, the size of the units, and the installation requirements. Motor suppliers were similar to mechanical suppliers in their efficiency actions. Three of the four motor suppliers indicated that they promote energy efficient motors at least half of the time. Motor suppliers noted that energy efficiency was not always appropriate and that larger projects typically called for a greater focus on energy efficiency than smaller ones.

Energy Efficiency Decision-Making

The different market actors had different perceptions about which party makes decisions about energy efficiency. Their perceptions tend to vary with their role in the process. Electrical and general contractors say that the primary decision-maker for equipment selection is the building owner, followed by the architect or engineer. These contractors rarely see themselves as the key decision-maker. Mechanical contractors perceive themselves as the primary decision-maker for equipment selection, followed by the building owner. For remodeling and equipment replacement, mechanical contractors see themselves as making the decision at least half of the time. Interestingly, general contractors noted that for design-build projects no single party, including the owner, tends to lead the decision-making; rather, they describe it as highly collaborative.

We asked designers somewhat different questions regarding efficiency decision-making than we asked of contractors. Architects and engineers were asked what professionals are typically involved in decision-making. Architects reported that architects usually took the lead for lighting and mechanical design, though for both types of systems engineers also were seen as often taking the lead. Architects and engineers described mechanical contractors—but not electrical contractors—as sometimes taking the lead in decision making. This findings provides some support to the self-perception of mechanical contractors.

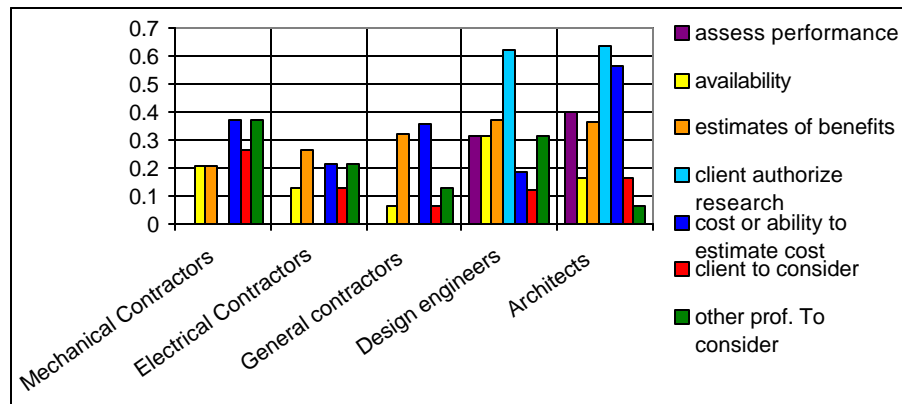
The strong role that mechanical contractors see themselves as playing, as well as the strong role that all parties see for architects, engineers, and owners suggests that these parties are key players in the decision making process for equipment selection. Suppliers were not asked about the key decision-maker.

Barriers to Implementing Energy Efficiency

For purposes in this report, barriers have been identified as those factors that interviewees most frequently rated a four or five on a five-point scale, where five was defined as a “major problem”. We found the major barriers to energy efficiency from the perspective of the contractors and designers to be similar, although not identical.

Perceptions of barriers are shown in Figure 4. They are consistent with the national market for energy efficiency.¹³ Furthermore, these perceptions are consistent with findings presented in the next section about the experience of market actors with energy efficiency.

Figure 4 – Barriers to Including Energy Efficiency in Projects



An opinion shared by all of the market actors, but endorsed most strongly by architects and engineers, is that their difficulty in providing clients with reliable estimates of the benefits of energy efficiency constitutes a barrier. Architects and engineers rated the ability to assess the performance of equipment in a specific application and the willingness of the client to authorize research into performance and benefits as very substantial barriers to energy efficiency in construction projects. These concerns are shared widely among the architects and engineers we interviewed.

Contractors see other contractors as major barriers to energy efficiency. Mechanical and electrical contractors point to general contractors as a barrier, while general contractors point to

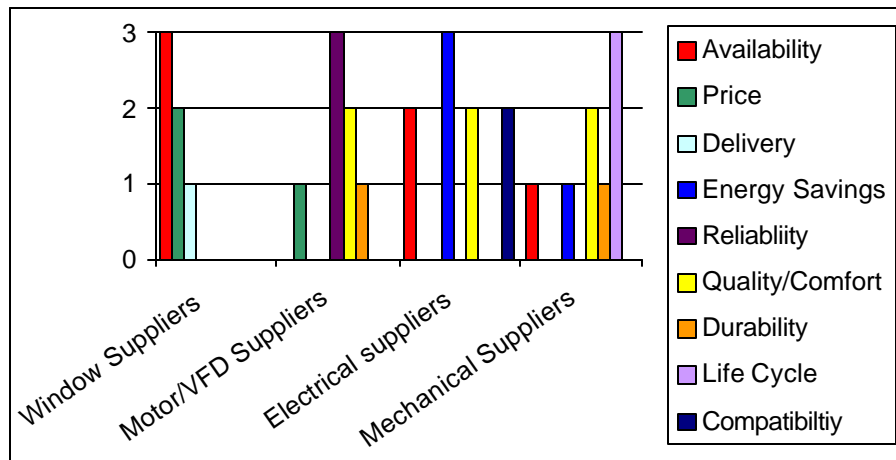
¹³ Work done by Research Into Action, Inc. for the Northwest Energy Efficiency Alliance Architecture + Energy Program, also found that architects viewed the ability to develop reliable estimates of costs and benefits and getting the client to authorize research as major barriers to energy efficiency.

subcontractors as a barrier, though less of a barrier than the subcontractors see the general contractor. Engineers similarly see getting architects to consider options as a barrier; however, architects do not see engineers as a barrier.

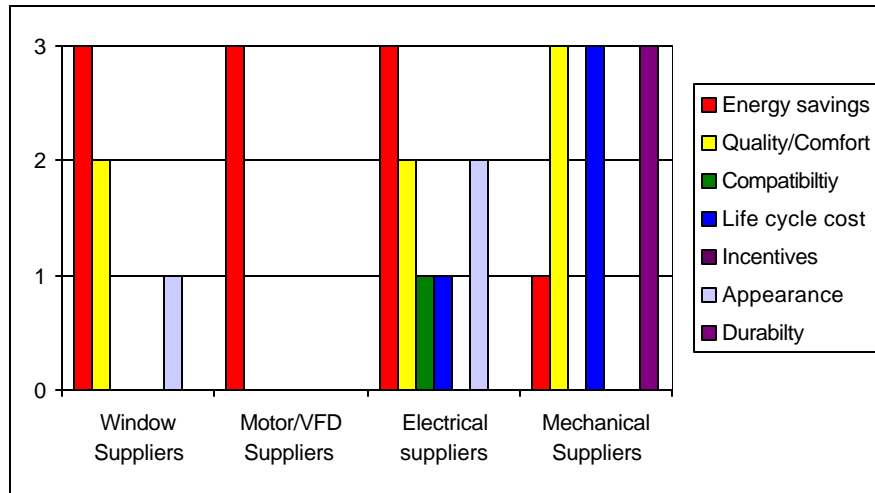
Contractors also see the cost of energy efficiency options as a major barrier. Architects see as a major barrier the ability to provide reliable estimate of the costs, though engineers do not share this concern.

To explore supplier barriers, we asked suppliers first to tell us what features were most important to their customers and then to discuss the factors they consider to be the selling features of energy efficient products. As shown in Figure 5, the top features that suppliers' say are most important to their customers varied across the four types of suppliers. Energy savings or life cycle cost appeared among the three most important features for two of the supplier groups, along with initial price and durability. However, availability and quality/comfort were more often mentioned as an important feature to customers. These factors appeared among the top three features for three of the suppliers.

Figure 5 – Top Features of Interest to Supplier Customers



Next, suppliers reported their views on the top selling features for energy efficient equipment. Figure 6 shows that energy savings is the top selling feature for all suppliers except HVAC suppliers; HVAC suppliers rate it third, although they rate life cycle cost as first. Quality and comfort, appearance, and life cycle cost follow energy savings for two of the three other supplier groups. Incentives, durability and compatibility each rank in the top three selling features for at least one of the supplier groups.

Figure 6 – Top Selling Features of Energy Efficient Equipment

Barriers to increasing the market share of energy efficiency products are evident when the features most important to customers are compared to those that suppliers describe as the selling features of energy efficient equipment. Suppliers report that customers consider availability, perceived quality/comfort, initial price and durability most important. Of these, only quality and comfort and durability are also on the suppliers' lists of selling features for energy efficient equipment. Energy savings, while in the top three features customers consider important, is usually ranked third in the customer's view, yet it ranks as the number one selling feature by suppliers.

These findings clearly point to a barrier for suppliers selling energy efficient equipment. When buyers and sellers hold the perception that a product's main selling feature is energy savings, sellers will be at a loss to promote the equipment to customers who are not particularly interested in this feature. In these instances, suppliers will have little means to increase their sales of energy efficient equipment without substantial education of the customer population and effort on the part of energy-efficient equipment manufacturers and efficiency advocates to illuminate the selling features that align with customer interests.

Barriers to energy efficiency from the view of designers, contractors, and suppliers remain quite challenging to address. Driven in part by the difficulty architects and engineers report in providing clients with reliable assessments of performance, benefits and costs, contractors and suppliers find little alignment between the customers desires for equipment characteristics and the selling features they are familiar with for energy efficient equipment.

Were changes such as the following to occur, they would suggest that barriers to energy efficiency are being reduced:

- Suppliers begin to tout features other than energy savings for the energy efficient equipment they sell.
- Architects and engineers are able to gain assistance and increased capability in assessing performance, benefits and costs.
- Contractors find costs easier to estimate and find each other more willing to discuss and consider energy efficiency options.

Current Energy Efficiency Practices

This section discusses market actor experience with energy efficiency measures and practices and the types of measures sold or recommended. Because each group of market actors deals with different types of equipment, we asked the groups different questions and need to look at each group independently.

Architects and Design Engineers

Architects and design engineers working on commercial and industrial buildings in Vermont have moderate familiarity with efficiency options. Those designers that are familiar appear to specify these types of solutions on less than half of their projects. Firms with larger work volumes and more staff tend to have somewhat more familiarity with these measures and tend to specify them slightly more often. However, it is also true that some small firms are very knowledgeable about and experienced with energy-efficient design. What is very clear is that to fully understand the extent to which firms' practices includes energy efficiency options, it is necessary to ask them to specifically describe the types of options they specify, rather than rely on general statements of knowledge or use of energy efficiency solutions.

We asked architects and design engineers very detailed questions about their energy efficiency practices. The questions proceeded from pre-design practice through specific systems that have energy efficient options. Both architects and engineers reported that during the pre-design phase of projects they typically discuss energy efficiency with clients and with other design team members. More engineers (62%) however, reported that they frequently set energy goals than did architects (33%).

Four (25%) of the engineers reported incorporating a variety of passive systems to reduce HVAC load and said that they did this for about 20% of their projects. In contrast, 15 (50%) of the architects reported doing designs that include a variety of passive system features that go beyond the use of operable windows and said they did so on over 50% of their projects.

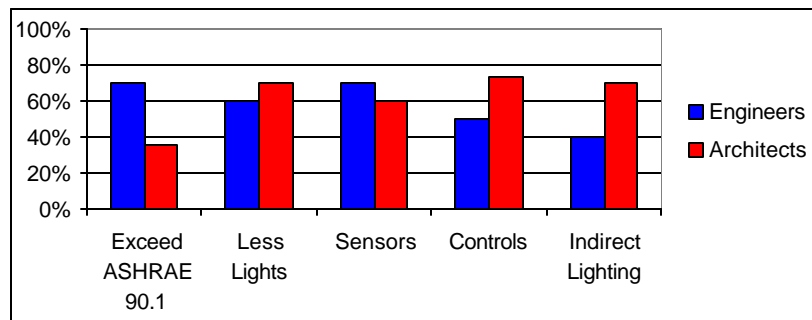
All of the architects and engineers who were involved in specifying glazing materials indicated that they specified low-e coatings for windows. However, only one engineer (of the three who specify glazing) and three architects (of the 30 who specify glazing) were able to recall the solar heat glazing function (SHGF) that they typically specified. Two designers said they specify SHGF less than .4 and the other two said they specify SHGF between .51 and .6.

Some use of day lighting was reported by 5 (31%) of the engineers and 23 (76%) of the architects. Because day lighting might imply to some respondents simply the use of extra windows, we asked about specific day lighting features and about the use of a day lighting strategy. The specific features were endorsed less frequently than was the general term day lighting. The use of day lighting strategies were reported by 3 (19%) of the engineers and 11

(36%) of the architects. Even fewer designers said they had used automatic dimming to maximize the benefits of day lighting (two, or 13%, of the engineers and ten, or 30%, of the architects). The designers doing day lighting reported the percent of their projects; percents ranged from less than 1% for one large firm (i.e., one project) to about half for some of the smaller firms.

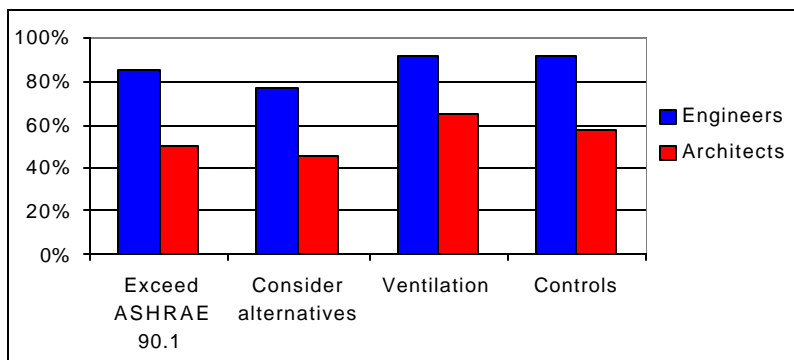
Figure 7 highlights the lighting design practices identified by our engineer and architect respondents. Engineers who are involved in lighting design (10 of the 16 we spoke with) were more likely to be familiar with ASHRAE standards than were the architects and to indicate that they design projects to exceed the ASHRAE 90.1 1999 standards. Yet engineers were less likely than architects to specify each of a variety of lighting features that increase the efficiency of the lighting systems.

Figure 7 – Engineer and Architect Lighting Design Practices



As shown in Figure 8, HVAC design practices paralleled the lighting design practices with regard to the use of ASHRAE standards. Engineers who design HVAC systems (13 of the 16 engineers) were more familiar with and more frequently claimed to design projects to exceed ASHRAE 90.1 1999 standards, than did architects. Yet unlike the lighting design practices, engineers also more frequently claimed to pursue one or more specific energy efficient design practices than did architects who design HVAC systems (13 of the 30 architects).

Figure 8 – Engineering and Architectural HVAC Design Practices



We asked the 13 engineers who specify HVAC equipment about the specific HVAC measures that they specify. These engineers reported a high level of familiarity with different HVAC measures. Seven engineers reported specifying variable air volume (VAV) systems, ten reported considering alternatives to packaged HVAC systems, and twelve reported specifying economizers. Economizers were specified by five of the engineers for 80 percent of their projects. Dual and single enthalpy economizers were the most commonly specified. However, for measures other than economizers, VAVs, and alternatives to packaged HVAC systems, most of the engineers reported that they specified these solutions in 20% or less of the projects they worked on.

Between 50 and 60 percent of architects and engineers report that they use modeling as a design tool. The most common application by engineers is to simulate cooling and heating for sizing HVAC equipment; the most common application by architects is to simulate lighting. Modeling, however, appears to be used on about 50% or less of the projects that most of these architects and engineers work on. A minority—three engineers (19%) and three architects (10%)—report using it on more than 75% of their projects. Life cycle cost analysis is used by about the same percent of architects and engineers that reported using modeling, and is used on a comparable proportion of projects as modeling.

Thirty percent of the engineers and 40 percent of the architects reported that they had used commissioning, yet only 23 percent of the architects and 12 percent of the engineers had used a third-party agent for commissioning. Comments from both architects and engineers clearly indicate two common perceptions: (1) third party commissioning is no more valuable than commissioning done by their own staff; and (2) they perceive commissioning to be so poorly defined that it does not hold value for them.

General Contractors

General contractors appear to have more experience with day lighting than any other group of market actors we spoke with. Eighteen of the 31 general contractors (31%) claimed to have worked on a project that included day lighting features in the past year. Roof designs with skylights and clerestories and shading devices were the day lighting solutions used by 30 to 50 percent of the general contractors. Given that a full day lighting strategy takes into account heating and cooling loads, this finding suggests that perhaps 15 percent of the general contractors are experienced with day lighting, a figure which is more consistent with the other market actor groups.

One general contractor reported experience installing a micro-turbine and eight contractors (25%) reported experience with third party commissioning. However, of the 146 new construction projects general contractors had worked on in the past year, less than five percent (8) had third party commissioning.

The most commonly used efficiency measures were insulation (wall R19—over 80% of the contractors, roof R38—over 50% of the contractors), and low e-coatings on windows (68% say they use low-e glazing 100% of the time). However, only 39% (12) were familiar with the term SHGF rating, and only two general contractors knew the specifications for the windows they install. As might be expected, contractors report slightly higher use of these measures in new construction than in remodeling projects.

General contractors appear to have limited awareness of efficiency measures that they can influence. Other than low-e windows and insulation, there is limited experience with efficiency measures; and even with low-e windows and insulation, the penetration of these measures into projects could increase, especially in the remodeling market.

Electrical Contractors and Lighting Suppliers

As with the other contracting and supplier groups in Vermont, the electrical contractors and lighting suppliers evidenced some awareness and familiarity with energy efficient solutions. The use of these solutions, however, focuses on T8 fixtures, occupancy sensors and compact florescent fixtures. Controls, automatic dimming ballasts and other solutions are used infrequently and lack wide availability.

Electrical contractors report high levels of experience (4 or 5 on a five-point scale where 5 is very experienced) with high efficiency lighting (65%) and occupancy sensors (48%), but not with any other energy efficient lighting option. This varied only slightly by size of firm, with those firms with more than five employees reporting higher levels of experience than those with less than five employees. Only 30 percent of the electrical contractors had experience in working on projects that exceeded the ASHRAE 90.1 standards; another 26 percent did not even know what the ASHRAE standards were.

Table 2 displays the percent of electrical contractors reporting that they were somewhat or very experienced with electrical system efficiency solutions. One-quarter of contractors said that they were experienced with T-5 lighting, building-wide lighting controls, and on-site generation.

Table 2 - Electrical Contractors Stated Level of Experience with Efficiency Measures/Methods

Energy Efficiency Equipment/Methods	Percent Somewhat or Very Experienced
T-5 lighting	26%
Building-wide lighting controls	26%
Energy management systems	18%
Automatic day light dimming	17%
Life cycle costing	13%
Third party commissioning	13%

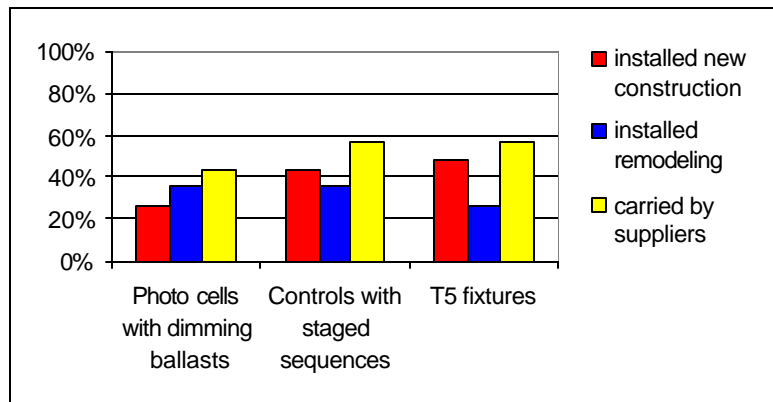
Looking across all measures that could be installed, contractors report slightly more installation activity in new construction and renovation projects than in remodeling and equipment replacement projects. Compact florescent and T8 fixtures for all types of construction and pulse start metal halide and high intensity discharge lamps for new construction are reportedly installed in over two-thirds of projects.

Most of the targeted products were carried by at least 40 percent of the lighting suppliers, with the following measures carried by 80 to 100 percent of the suppliers:

- magnetic ballasts,
- LED exit signs,
- on-off occupancy sensors,
- regular metal halide,
- pulse start metal halide,
- T-8 and T-12 fixtures, and
- compact florescent fixtures.

The measures that are of particular note for the evaluation are included in Figure 9

Figure 9 - Percent of installation or availability for key lighting measures



Mechanical Contractors and HVAC Suppliers

The mechanical contractors appear to have somewhat more experience with energy efficiency measures than electrical contractors and we would expect HVAC suppliers to be similarly more familiar with energy efficient solutions. Unfortunately, baseline measures for the mechanical equipment can only be provided for contractors. Because some suppliers did not understand the terminology, even awareness and availability measures cannot be estimated for them.

Over half of the mechanical contractors report that they are somewhat or very experienced with high efficiency HVAC, HVAC alternatives to packaged cooling and heating units, variable speed drives, energy management systems, and the energy analysis of HVAC options. Less than 37 percent report similar levels of experience with other HVAC measures such as variable air volume fans, third party commissioning, life cycle costing and on-site generation. Table 3 displays these levels of experience.

Table 3 - Mechanical Contractors Stated Level of Experience with Efficiency Measures/Methods

Energy Efficiency Equipment/ Methods	Percent Somewhat or Very Experienced
Variable air volume fans	37%
Life cycle costing	26%
Third party commissioning	26%
On-site generation	21%

All but two contractors use at least some method for sizing HVAC systems. The most commonly used method is software modeling, both for new construction (63%) and remodeling/replacement construction (53%) projects. Those who do not use software are more likely to use manual calculations than rules of thumb. Only one contractor indicated that over 75% of the time he replaces equipment with the same sized equipment, thus not using any sizing techniques.

More mechanical contractors (68%) than electrical contractors (30%) indicated awareness and familiarity with using the ASHRAE standards. Of those familiar with the standards, more mechanical contractors indicated that their projects exceeded the ASHRAE 90.1 1989 standards than indicated they exceeded the 1999 standards, though this difference is small. This finding suggests that there is some effort to try to “keep up” with changes.

Of the various types of HVAC equipment that could be installed for efficiency, the most commonly installed measures are programmable thermostats (95% new construction, 63% remodeling), single enthalpy economizers (63% both new and remodeling), VAV systems (68% new construction, 53% remodeling), and energy management systems (63% new construction, 53% remodeling). Not surprisingly, the suppliers we spoke with also carry these measures. Only three of the mechanical contracting firms report installing chillers in either new or remodeling projects. All three of these firms have large project volumes and large staff.

We also asked mechanical contractors a very general question about their practices for packaged systems. Most contractors responded that they install high efficiency packaged systems (74% new construction, 63% remodeling). However, suppliers were unable or unwilling to provide detail about the types of packaged systems they sell. As noted, some of the suppliers had difficulty with the terminology of packaged heating and cooling systems; this certainly contributes to the lack of response regarding efficiency data. Only one of the four suppliers indicated they sold any units in excess of SEER 13 for 5.4 ton systems (the smallest size) or EER 11 for 5.4-11.25 ton systems. We suspect, however, that the actual use of higher SEER and EER units is less than implied by the contractors' response.

Window Suppliers

Window suppliers claimed high levels of knowledge about energy efficient products. The seven window suppliers we spoke with overwhelmingly agreed that they were knowledgeable about energy efficient products and that they promoted energy efficient products to their customers.

Unfortunately, as noted five of the seven window suppliers misunderstood some of our questions about products they sell. As a consequence we did not obtain any information about the types of windows these five suppliers sell. For the two suppliers who understood our terminology (glazing as a term for windows), we obtained information on the types of windows they sell and the specialty windows they sell: custom storefronts and curtain walls.

The two suppliers who reported the types of glazing they use in their windows indicated that they sell double or triple paned windows 70 to 100 percent of the time. One of the two suppliers did not know the SHGF for the windows he sold; the other estimated that 85 percent

of his window sales have SHGF less than .49 and 15 percent have SHGF over .49. He reported that all of his windows have low-e coatings.

The suppliers selling custom storefronts primarily sell double pane windows without low-e coating. This product was sold for about half of the storefronts one supplier sold and about two-thirds of the storefronts for the other. However, for both suppliers custom storefronts make up only 10 to 15 percent of their total annual sales. The one firm also selling custom curtain walls reported that these sales are two percent of their total annual sales, and that 100% of the sales are for double pane windows with low-e coatings.

Motor Suppliers

Similar to other equipment suppliers, four of the five motor suppliers indicated that they actively promote or recommend motors that exceed standard efficiency levels. However, we believe that this may overstate the actual promotion activities. The MotorUp evaluation noted that motor suppliers across New England have shown “very spotty and inconsistent progress” in participation in the MotorsUp program.¹⁴ Many suppliers participate in that program, but 50 of the 225 regional firms account for 75 percent of the incentives.

The efficiency product focus for the suppliers we interviewed was not motors but rather variable frequency drives (VFD), which are not addressed by MotorUp. For VFDs, one of the motor supplier rated himself as moderately knowledgeable (a 7 on a ten-point scale with 10 being very knowledgeable). The other four suppliers rated themselves as not knowledgeable (a 3 or less). Three of the suppliers indicated that they sell VFDs and that most of the applications were industrial, with a very small number of sales for HVAC applications.

¹⁴ *MotorUp Evaluation and Market Assessment*. Prepared by Xenergy for the Northeast Energy Efficiency Partnership. Boston, MA. November 2001.

Baseline Measurements for Market Indicators

This section describes the market indicators that we consider viable to track and the current baseline measure. We identify these measures as viable because they demonstrate significant opportunity for change as they are generally occurring at a low level among the market actors we spoke with.¹⁵ While we noted some differences, we did not find any substantial difference between the rates of these activities for new construction versus remodeling and so a single baseline measure is recommended. Based on results from the GDS team's market actor surveys completed to date, specific market indicators and current baselines, where appropriate, are presented for the following Vermont commercial and industrial market actor areas:

- Architects and Engineers,
- General Contractors,
- Electrical Contractors and Lighting Suppliers,
- Mechanical Contractors and HVAC Suppliers,
- Window Suppliers, and
- Motor and VFD Suppliers

One other market indicator that should be considered is awareness of the 2001 Vermont Guidelines for Energy Efficient Commercial Construction. These guidelines are based on ASHRAE 90.1, 1999 and are just being promulgated in 2002. The fact that we found limited awareness of the ASHRAE standards outside of engineers and architects suggests that tracking the awareness of ASHRAE standards could be useful. However, with the advent of the guidelines, we suspect that those currently unaware of ASHRAE may become aware of the guidelines without realizing the role of the ASHRAE standards. If awareness of the guidelines is accepted as a market indicator for engineers, architects, general contractors, and electrical and mechanical contractors, we believe that the baseline measure for each market group would be less than 5%.

Architects and Engineers

Market Indicator #1: Use of day lighting strategy in design practice (any project in past year)

Current Baseline: 35% architects, 19% engineers.

Market Indicator #2: Specification of photo-dimming to enhance day lighting (any project in past year)

¹⁵ The DPS may chose to modify this list if some measures are not to be targeted by EVT. Other modifications might occur to the baseline measure if additional data are collected, especially for suppliers, that might make it possible to track actual product sales. The indicators currently recommended for suppliers focus on availability and awareness, not actual sales or penetration.

Current Baseline: 30% architects, 10% engineers.

Market Indicator #3: Awareness of SHGF rating among those who specify glazing

Current Baseline: 10% architects, 30% engineers 30%.

Market Indicator #4: Use of modeling for HVAC and lighting (on 50% of all projects)

Current Baseline: 50-60% architects and engineers.

Market Indicator #5: Use of third party commissioning:

Current Baseline: 23% architects, 12% engineers.

General Contractors

Market Indicator #1: Experience with third party commissioning

Current Baseline: 26%.

Market Indicator #2: Experience with day lighting

Current Baseline: 15%.

Market Indicator #3: Awareness of SHGF rating

Current Baseline: 38%.

Electrical Contractors and Lighting Suppliers

Proposed indicators for the Electrical Contractors focus on stated experience of “somewhat” or “very experienced” with key efficiency measures:

Market Indicator #1: Energy management systems

Current Baseline: 18%.

Market Indicator #2: On-site generation

Current Baseline: 26%.

Market Indicator #3: Life cycle costing

Current Baseline: 13%.

Market Indicator #4: Third party commissioning

Current Baseline: 13%.

Market Indicator #5: Automatic daylight dimming

Current Baseline: 17%.

Market Indicator #6: Building-wide lighting controls

Current Baseline: 26%.

Market Indicator #7: T-5 lighting

Current Baseline: 26%.

Proposed indicators for Lighting Suppliers focus on percent of suppliers reporting to stock (or carry) key efficiency measures.

Market Indicator #1: Photo-cells with dimming ballasts

Current Baseline: 43%.

Market Indicator #2: Controls with staged sequences

Current Baseline: 57%.

Market Indicator #3: T-5 fixtures

Current Baseline: 57%.

Mechanical Contractors and HVAC Suppliers

Proposed indicators for the Mechanical Contractors focus on stated experience of “somewhat” or “very experienced” with key efficiency measures.

Market Indicator #1: Experience with variable air volume fans

Current Baseline: 37%.

Market Indicator #2: Experience with on-site generation

Current Baseline: 21%.

Market Indicator #3: Experience with life cycle costing

Current Baseline: 26%.

Market Indicator #4: Experience with third party commissioning

Current Baseline: 26%.

Indicators for HVAC Suppliers are not recommended. Additional follow-up research is needed to develop a viable baseline. Likely indicators are stocking of:

Packaged or split system heat pumps or AC, 5.4 tons, SEER >13
Packaged or split system heat pumps or AC, 5.4-11.25 tons, EER >11
Dual enthalpy economizers

Window Suppliers

Proposed Market Indicator: Awareness of SHGF rating
Current Baseline: less than 10%.

Motor and VFD Suppliers

Proposed Market Indicator: Knowledge of VFDs (self-rated as above a 3 on a ten-point scale)
Current Baseline: less than 20%.

Program Process Findings

This section describes market actor response to Act 250 and EVT.

Act 250

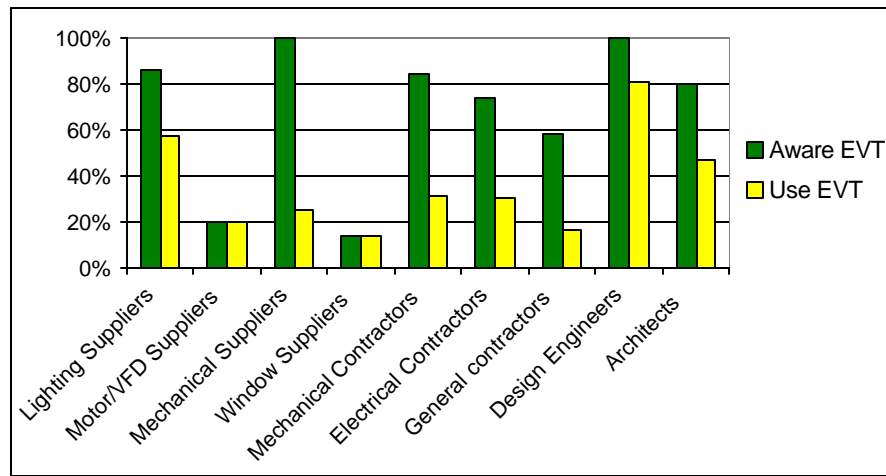
Overall, the impression from market actors is that Act 250 does not change the way projects are designed very much. Some commented that the process was useful including more efficiency and in helping the designer leverage efficiency into a project. Others commented that it was cumbersome or that requirements were arbitrary. Overall, like most regulations the market actors have found ways to work with the requirements.

About three-quarters of the engineers and three-quarters of the architects have been involved in projects that faced Act 250 review. About half of the general contractors and around 20 percent of the electrical and mechanical contractors have similar exposure. Engineers were more likely than any other group to believe that the Act 250 review process improved the energy efficiency of the projects they worked on (68% thought so). Architects split about 50/50 in concluding that the energy efficiency of the projects was increased by the Act 250 process.

Almost all of the lighting, HVAC and windows suppliers were aware of Act 250. Lighting suppliers thought that customers with Act 250 projects tended to buy more energy efficient equipment, but neither HVAC suppliers nor window suppliers concurred. Not surprisingly, given the role of motors in process needs rather than building equipment, motors suppliers had limited awareness of Act 250.

Efficiency Vermont

Most of the market actors are aware of EVT. As shown in Figure 10, awareness is highest for architects, design engineers, mechanical contractors, and HVAC and lighting suppliers. Use of EVT services runs at less than half the level of awareness for most of the market actors; design engineers and lighting suppliers have relatively higher levels of usage. The only window and motor suppliers that we spoke with who are aware of the EVT have also used EVT services.

Figure 10 - Awareness and Use of EVT Services by Market Actors

Architects and engineers report mainly using project assistance services and attending the February Building Solutions conference. Architects also report using rebates, while engineers do not. Contractors and suppliers, in contrast, were much more likely to use the rebates or technical assistance; very few had attended the Building Solutions conference.

Satisfaction with EVT services is quite high. Generally over 70 percent of those who used EVT services in each market actor group rated their level of satisfaction as either a four or a five on a five-point scale, where 5 is very satisfied.

Some comments, however, suggest that EVT has opportunities to improve. One electrical contractor was dissatisfied with EVT's knowledge of efficient solutions and the usefulness of the information. One general contractor was dissatisfied with the quality of the services. One architect was dissatisfied with these same three aspects of the service, as was one engineer. Their comments suggest that EVT could expand its staff knowledge of practical issues contractors face, especially in the more rural areas of Vermont. Yet most of the comments point to the benefits of EVT and the opportunity EVT has to increase the knowledge and awareness of contractors and suppliers for energy efficient equipment throughout Vermont. As one respondent says: "Often contractors have never seen these options before. EVT has got to get the word out!"

Recommendations

This section provides our recommendations about the market actors in Vermont.

As noted in the program description, the EVT commercial and industrial program effort is primarily a resource acquisition effort. We therefore are not surprised to see in this market actor research that larger firms with larger volume of business typically are more aware of energy efficient solutions and more likely to report implementing them. A focus on the entire market, however, is also called for and to do that may require an expansion of the current focus EVT has on kWh savings.

The research has demonstrated that market actors in Vermont have a moderate level of knowledge about and experience with energy efficient options. There is considerable opportunity to enhance this knowledge and experience. EVT has already garnered a substantial level of awareness among designers in Vermont; where rebates are available (lighting and HVAC), that awareness includes contractors and suppliers.

Architects and engineers have been the primary users of EVT educational efforts, and these market actors typically respond that they have experience and knowledge of efficient solutions. Based on this review it appears that EVT needs to successfully reach deeply into the contractor and supplier market place, to expand the knowledge of and experience with efficient products among contractors and suppliers.

Once this is accomplished, architects and engineers will have less difficulty translating what they know is possible into completed energy efficient projects. In addition, since architects and engineers appear to be involved in less than half of the construction projects that occur in Vermont in any one-year, reaching deeply into the contractor and supplier market place will be critical to accomplishing any large scale market change.

The next steps for the market actor research should include the following:

- Continued efforts toward completion of end-user telephone surveys and implementation of scheduled on-site visits. Results from these ongoing data collection activities must then be analyzed and incorporated into a revised market assessment report to help solidify baseline values of key measurement indicators (where applicable) and for use by EVT in guiding future program enhancements.
- Expanded data collection for suppliers to ensure that a better estimate of baseline market conditions for key products is completed. Such data collection should focus on targeted measures, rather than the lengthy lists used in the initial data collection effort.

- A program theory workshop to explicate the program logic and identify opportunities for process improvement for the CEO and CEIM programs.
- Review of EVT data on market actors who have had contact with EVT. The purpose of this review would be to determine how many unique market actors have used EVT services and where the market actors are located. Then a sample of interviews could be conducted to obtain more detailed information on program process issues.

Population and Sampling Framework

This Chapter discusses the sampling framework by first reviewing the characteristics of Vermont's population and then discussing nonresidential new construction permit data for Act 250 projects, and from the Vermont Department of Labor and Industry permit data, and nonresidential existing construction permit data from the Vermont Department of Labor and Industry. The detailed sampling plans that were developed based on this analysis of the population are presented in Appendix C.

Vermont's Population Characteristics

To provide a context for understanding the commercial and industrial markets in Vermont, we provide a brief description of the state's population density. The data reported herein is from the 2000 US Census, the most recent census.

Vermont is a small and rural state, with 608,827 residents. The average number of persons per square mile is 66, less than the average for the nation as a whole—80 people—which includes large amounts of territory in northern Alaska that are barely inhabited and some sparsely populated western states. Comparisons are with Vermont's neighbors show the following:

- Upstate New York has significant rural areas, yet the state as a whole has 402 persons per square mile.
- Western Massachusetts is somewhat rural, yet Massachusetts has 810 persons per square mile.
- Vermont's eastern neighbor, New Hampshire, has double Vermont's density with 138 persons per square mile.

Small farms and towns characterize Vermont. Its low population density is about twice that of the large farming states in the nation. Kansas and Nebraska have 33 and 22 persons per square mile, respectively.

The largest city in Vermont is Burlington, which has a population of almost 39,000. Its second largest city is Essex, with less than 19,000 people. Third is the city of Rutland with just over 17,000 people. Both Burlington and Essex are in Chittenden County, along with the fourth and fifth largest towns, Colchester and South Burlington City.

Chittenden County has a more urban/suburban mix than the rest of the state. For example, although Rutland is the third largest city in Vermont, Rutland County has 68 persons per square mile compared to Chittenden's 272 persons per square mile. The Vermont population by county is provided in Table 1. (A map showing the size and locations of Vermont's counties is provided in the next section, along with commercial/industrial new construction permits.)

Table 1 - Population by County

County	2000 Population
Addison	35,974
Bennington	36,994
Caledonia	29,702
Chittenden	146,571
Essex	6,459
Franklin	45,417
Grand Isle	6,901
Lamoille	23,233
Orange	28,226
Orleans	26,227
Rutland	63,400
Washington	58,039
Windham	44,216
Windsor	57,418

This study generally looked at three geographic distinctions in Vermont. Given the more urban nature of Chittenden County, it comprised its own category. The populations of all towns with more than 7,500 residents are given in Table 2 with those that are located in Chittenden County noted. The cities in this table that are outside of Chittenden County comprise the small urban category, which is the second geographical category. The third category—rural—comprises all other locations in the state.

Table 2 - Urban Areas with Population Greater than 7,500

	Geographic Area	Total Population	Within Chittenden County
1.	Barre city	9,291	
2.	Bennington town	15,737	
3.	Brattleboro town	12,005	
4.	Burlington city	38,889	X
5.	Colchester town	16,986	X
6.	Essex town	18,626	X
7.	Hartford town	10,367	
8.	Middlebury town	8,183	
9.	Montpelier city	8,035	
10.	Rutland city	17,292	
11.	So Burlington city	15,814	X
12.	Springfield town	9,078	

13.	St. Albans city	7,650	
14.	St. Johnsbury town	7,571	
15.	Williston town	7,650	X

Nonresidential New Construction

We provide an overview of Vermont's nonresidential new construction market, drawing upon data from the 1997 US Census of Construction.

The 1997 Census of Construction shows a total of \$1.7 billion spent on construction in Vermont. One-fourth of this total, however, was devoted to heavy construction such as highways, streets, bridges, water, and power. The remaining construction money includes land development, excavation, and water well drilling contractors, in addition to building construction. Nonresidential building construction exceeded \$319 million and residential construction was over \$341 million. In addition, about one-third to one-half of \$587 million ascribed to special contractors likely applies to nonresidential structures. Special contractors include the trades of plumbing, air-conditioning, carpentry, roofing, and glass.

The Vermont construction businesses that are large enough to have payrolls conduct over 75% of their business in Vermont (\$1.3 billion of the \$1.7 billion industry). The rest of their business is conducted in New Hampshire, New York, Massachusetts, and Maine (in order of dollar value done there).

The construction businesses with payroll did over \$735 million of building, developing, and general contracting business in the residential and nonresidential sectors in 1997. Of this, 59% was building construction on land owned by others, with the businesses working in the role as either a general contractor or design-builder. Another 17% was construction management of buildings. Remodeling general contractors or remodeling design build business constituted another 15% of this business. The final 8% was building construction on land owned by the builder for sale.

Table 3 presents the 1997 value of nonresidential construction work by building use for construction businesses with payroll.

Table 3 - 1997 Nonresidential Construction Value for Vermont Construction Businesses with Payroll

Building use	\$ Millions
Manufacturing & light industrial	\$214.8
Educational buildings	\$125.3
Office buildings	\$70.6

Hotels and motels	\$62.1
Health care and institutional buildings	\$41.2
Commercial warehouses	\$40.0
Public safety buildings	\$28.5
Amusement, social, and recreational buildings	\$9.4
All other commercial buildings	\$88.4
Other building construction	\$84.7

Nonresidential New Construction Permits

We used the Vermont permit data held by the Department of Labor and Industry to extract permit data for this study's analysis and surveying. Based on an assessment of the time it typically takes to move a nonresidential project from permitting to completion, we examined 1998 and 1999 permit data. This selection allows the overview of the permit data presented here to be consistent with the more detailed results being presented from survey findings.

A map of the state of Vermont showing the number of new construction permits for 1998 and 1999 by county is presented in Figure 1.

Figure 1 – 1998 and 1999 VT Nonresidential New Construction Permits by County

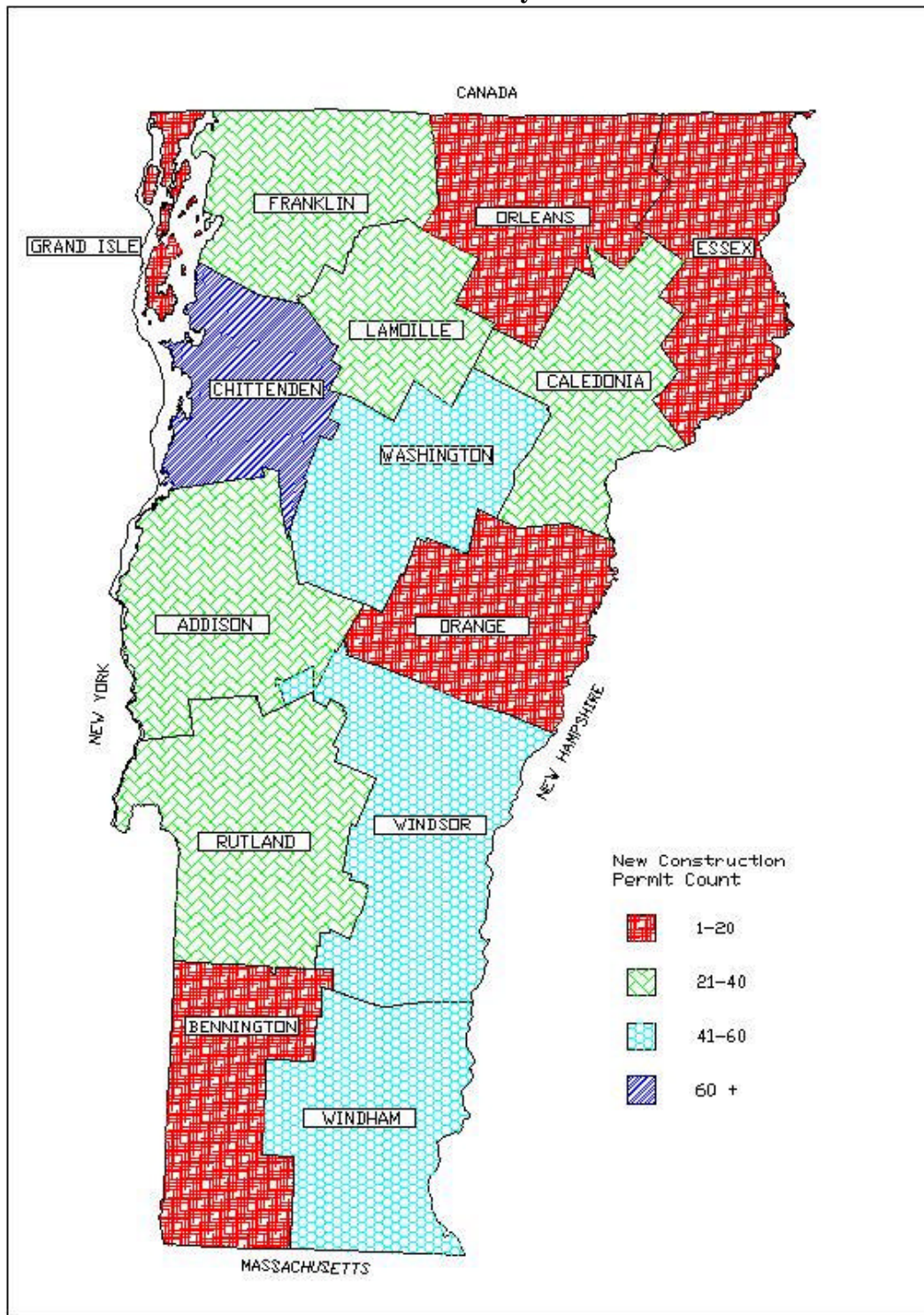


Table 4 identifies the number of nonresidential '98/'99 building permits, by building type. Both an aggregated and disaggregated categorization of building types is given. Apartments over two stories are within the commercial effort of EVT and thus are considered a nonresidential building type.

Table 4 - 1998 and 1999 Nonresidential New Construction Permits

Building Type—Aggregate	'98/'99 Permits	Percent of Permits	Building Type—Disaggregate	'98/'99 Permits	Percent of Permits
Office	75	16%	Office	54	11%
			Mixed use	21	4%
Retail	129	27%	Food service	8	2%
			Service	23	5%
			Retail	85	18%
			Grocery	13	3%
Industrial	40	8%	Industrial	40	8%
Warehouse, storage	90	19%	Warehouse, storage	90	19%
Institution, health care, assembly	73	15%	Health care	11	2%
			Institution (non school)	11	2%
			Public assembly	51	11%
School (non-college)	3	1%	School (non-college)	3	1%
Other	61	13%	Hotel	22	5%
			Utility (wastewater, pumping)	14	3%
			Apartments	5	1%
			Agriculture	1	0%
			Animals	2	0%
			Lodging	17	4%
			Misc/unknown	0	0%
Total	471	99% *	Total	471	99% *

* Percents do not equal 100, due to rounding.

The largest numbers of permits were issued for the construction of retail (including grocery, food service, and service) and warehouse (including storage) facilities. The aggregate retail category

comprises over one-quarter of all permits, and the aggregate warehouse category comprises about one-fifth of the permits. Next most prevalent are the aggregate categories of office and institutional/health care/public assembly, both of which comprise about one-sixth of the total.

The majority of the permits are for construction in the rural portions of the state. This is true for nonresidential construction as a whole and as well as for each of the aggregate building types (see Table 5). All of the construction for schools and over 60% of the construction for institutions, industry, and warehouses occurred in rural Vermont, as did between 40% and 50% of the office and retail space. Chittenden County has higher proportions of the new offices and retail space than it has of any other building sector, yet these proportions are nonetheless lower than the rural share of these building types.

Table 5 - 1998 and 1999 Nonresidential New Construction by Geographic Type

Building Type— Aggregate	'98/'99 Permits	Percent by Geographic Type		
		Chittenden	Small Urban	Rural
Office	75	35%	23%	43%
Retail	129	31%	20%	49%
Industrial	40	15%	23%	63%
Warehouse	90	16%	21%	63%
Institution, health care, assembly	75	23%	8%	69%
School	3	0%	0%	100%
Other	61	28%	15%	57%

As might be expected from the rural location of most nonresidential new construction, most of the permits were for small buildings. Almost half of the new construction permits that included square footage data were for projects smaller than 5,000 square feet. Only 13% are over 25,000 square feet (see Table 6).

Table 6. 1998 and 1999 Nonresidential New Construction by Square Footage

Size Category	'98/'99 Permits	Percent of Permits
Under 1,000	28	10%
1,000 – 4,999	108	37%
5,000 – 9,999	58	20%
10,000 – 24,999	61	21%
25,000 – 49,999	26	9%

50,000 – 74,999	7	2%
75,000 – 99,999	5	2%
100,000 or more	1	0%
Total with square footage data	294	100%
Total lacking square footage data	177	NA
Total permits	471	NA

As Table 6 shows, 10% of the projects are very small—less than 1,000 square feet—and two-thirds of the permits are for less than 10,000 feet. Yet there are 13 projects that dwarf these small ones, ranging from 50,000 square feet to over 100,000 square feet. These larger projects result in an average project size that suggests a building larger than the typical building. Table 7, therefore, provides a comparison of the mean (the average) and the mode (the size for which 50% of the buildings are larger and 50% are smaller) for each building type.

Table 7 – ‘98 & ‘99 Nonresidential New Construction Sq. Footage by Building Type

Building Type—Aggregate	Mean SF	Mode SF	Building Type—Disaggregate	Mean SF	Mode SF
Office	12,641	5,688	Office	9,032	5,616
			Mixed use*	19,859	5,785
Retail	11,162	7,200	Food service*	8,486	2,570
			Service*	4,866	4,800
			Retail	13,542	8,500
			Grocery*	7,443	2,400
Industrial	22,015	7,500	Industrial	22,015	7,500
Warehouse, storage	11,741	4,680	Warehouse, storage	11,741	4,680
Institution, health care, assembly	8,996	6,000	Health care*	18,597	12,600
			Institution (non school)*	6,763	7,069
			Public assembly	6,709	4,966
School (non-college)*	29,108	29,108	School (non-college)*	29,108	29,108
Other	12,206	6,000	Hotel*	17,997	16,600
			Utility (wastewater, pumping)*	3,201	1,890
			Apartments*	8,281	8,983

			Agriculture*	-	-
			Animals*	18,576	18,576
			Lodging*	13,464	8,557
			Misc/unknown	-	-

* Few permits were issued for these building types. Thus, their size characteristics may not be a good predictor of future facility sizes.

The larger buildings tended to be built in Chittenden County, resulting in a larger mean square footage by building type in Chittenden County than in the small urban or rural areas. There were about five exceptions to that. It is hard to extrapolate from the small number of permits in some geographic areas/building type categories to what might be expected in future years. For example, the grocery category had a much higher mean in the small urban area due to one quite large grocery discount warehouse being built there.

Nonresidential Renovation, Remodeling, and Additions

We also extracted the 1998 and 1999 permit data for Vermont's nonresidential renovation, remodeling, and additions for sampling and analysis. One-quarter of these permits for construction on existing retail buildings and another quarter are for construction on existing institutional buildings (see Table 8).

Table 8. 1998 and 1999 Nonresidential Remodeling, Renovation, and Additions Construction Permits

Building Type—Aggregate	'98/'99 Permits	Percent of Permits	Building Type—Disaggregate	'98/'99 Permits	Percent of Permits
Office	38	10%	Office	32	9%
			Mixed use	6	2%
Retail	103	28%	Food service	12	3%
			Service	27	7%
			Retail	46	13%
			Grocery	18	5%
Industrial	59	16%	Industrial	59	16%
Warehouse, storage	29	8%	Warehouse, storage	29	8%
Institution, health care, assembly	84	23%	Health care	22	6%
			Institution (non school)	14	4%
			Public assembly	48	13%

School (non-college)	21	6%	School (non-college)	21	6%
Other	34	9%	Hotel	12	3%
			Utility (wastewater, pumping)	5	1%
			Apartments	2	1%
			Agriculture	4	1%
			Animals	0	0%
			Lodging	5	1%
			Misc/unknown	6	2%
Total	368	100%	Total	368	100%

A comparison of Tables 4 and 8, provides insight into whether new construction or changes to existing construction dominate the construction activity for each building type. In the office sector, twice as many permits were issued for new construction as for renovation/remodeling. In the warehouse/storage sector, new construction permits were triple those of renovation/remodeling. Permits for new construction in the retail sectors exceeded those for renovation/remodeling by about 25%. On the other hand, in the institution, schools, and industrial sectors, renovation/remodeling permits exceeded those for new construction by 25% or more. Thus, the different building sectors will be differentially affected by efforts that relate to new construction and efforts relating to construction on existing buildings.

Placeholder for individual market actor group chapters – presenting results/write-ups from completed telephone surveys of Architects, Engineers, General Contractors, Electrical Contractors and Lighting Suppliers, Mechanical Contractors and HVAC Suppliers, Window Suppliers, and Motor Suppliers.

Appendix A – Researchable Questions

Researchable Questions for VT C&I Market Evaluation Work
(See Table from Preliminary Market Study)

Appendix B – Survey Instruments

EVT Staff & Initial Key Market Actor Surveys

Architects

Engineers

General Contractors

Mechanical Contractors/suppliers

Electrical Contractors/suppliers

Window suppliers

Motor/VDS suppliers

New Construction End Users

Existing Construction End Users

On-Sites (currently under development)

Appendix C – Sampling Plans

Market Actors

End-Users

On-Sites